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NUMBER 82

NOVEMBER 1944

THE BULLETIN

OF THE

U. S. Army Medical Department

A periodical containing original articles, reviews, news, and
abstracts of interest to the Medical Department of the Army

ISSUED UNDER THE AUSPICES OF
THE OFFICE OF THE SURGEON GENERAL

PUBLISHED MONTHLY AT THE MEDICAL FIELD SERVICE SCHOOL,
CARLISLE BARRACKS, PENNSYLVANIA

By direction of the Secretary of War, the material contained herein is published as administrative information for the proper transaction of the public business and with the approval of the Director of the Budget.

NORMAN T. KIRK
Major General, U. S. Army,
The Surgeon General.

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WAR DEPARTMENT
OFFICE OF THE SURGEON GENERAL.
WASHINGTON 25, D. C.

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Single copies, domestic, 25 cents ; foreign, 30 cents.

All other communications relating to this publication should be addressed
to The Surgeon General, U. S. Army, Washington 25, D. C.

Foreword

With the October 1943 issue, The Bulletin became a monthly periodical, instead of a quarterly, dedicated to keeping the personnel of the Medical Department informed on developments in war medicine. The new publication, known as The Bulletin of the U. S. Army Medical Department, absorbed the former quarterly dental and veterinary bulletins and will have material devoted to those fields in each issue.

The Bulletin is intended to be educational rather than directive in nature. It will contain the best information obtainable concerning military medical experience, observations, and procedure that may help to improve further the quality of professional services. The Bulletin will be a medium whereby experience gained in one theater of combat may be shared with those serving in other combat areas and with those in this country who are preparing for overseas duty. News items concerning military and scientific developments as well as original articles will be emphasized. The Bulletin, however, should not serve as a basis for the forwarding of requisitions for equipment or supplies referred to therein.

Obviously, some of the most interesting field experiences cannot be divulged in a periodical of this kind when our country is at war. The Bulletin will, however, publish that which can be safely told, drawing not only on current literature, but on many authoritative reports which reach The Surgeon General's Office from the field. Officers are invited to submit for publication reports of their field experiences that can profitably be shared with other officers.

The Medical Department has been commended for its work in caring for the sick and wounded in theaters of operations in war. The Bulletin will endeavor to stimulate such progress and to advance further the high standard of medical service in the Army of the United States.

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Notice to Contributors

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SKULL FRACTURES PRODUCED BY MISSILES

An extensively illustrated report on 100 consecutive cases of compound, comminuted fractures of the skull has been received from Lieut. Colonel Eldridge H. Campbell, Jr., M. C., stationed at a head center overseas. Seventeen different surgeons had operated on most of this group of patients and most of them had received primary treatment at installations near the front. Some reached the head center in a few days, others a week or two later. The injuries were incurred in Italy. Almost all of them had sulfonamide pack and a dry dressing applied to the wound within an hour or two after injury. While sulfanilamide tablets had been given in some instances, this was the exception rather than the rule in advance of the field or evacuation hospitals. Penicillin was not available. Of the 95 surviving patients, 23 were returned to duty in the theater and 72 were evacuated to the zone of the interior.

More wounds were caused by shell fragments than by all other means. Inner table fractures were sometimes overlooked and occasionally led to serious complications. Tripod incisions often gave trouble; it is recommended that they be avoided when possible. Convulsions were uncommon in the first few weeks; their occurrence was sometimes an early manifestation of abscess formation. Nineteen patients developed superficial wound infections, and in 22 the infections were deep-seated. These were manifested by abscess, meningitis, cerebral fungus, or some combination thereof. The five deaths all occurred in the latter group.

Incomplete débridement was the largest single factor contributing to wound infection. When all bone fragments had been removed, infection was uncommon and seldom deep, whereas, if débridement had been incomplete or not performed at all, infection was common and usually deep. Bacteria cultured from these wounds were principally skin inhabitants of low virulence. Treatment of abscesses consisted in evacuation of pus and removal of associated bone fragments and/or metallic foreign bodies, as well as of adjacent necrotic tissue and old blood. Abscess capsules were disturbed as little as possible. Sulfonamide therapy was employed as an adjuvant. Failures resulted in only those 5 cases in which this procedure was not carried out.

Experience, judgment, skill, and a proper neurosurgical armamentarium are prerequisite to good primary débridement. It is recommended that patients with severe head wounds be evacuated directly to a hospital in which these are available, even though an additional day is required.

RENAL CALCULI IN CONVALESCENT PATIENTS

While the tendency in certain types of patients, long bed-ridden, to develop renal calculi has been recognized for years, their development in robust young men on whom recumbent inactivity is suddenly forced by injuries after prolonged training seems to be an uncommon observation. In the seven months preceding April 1944, in a general hospital in North Africa fourteen patients were observed with renal and ureteral calculi or suspected renal calculi, and as they gave no history of previous passage of calculi, hematuria, or pain of similar nature, it was assumed that the calculi or gravel developed during hospitalization. The authors in civil practice had not encountered renal and ureteral colic in convalescent patients.

In twelve of the fourteen patients, hospitalization was necessary because of injuries or wounds. Eight patients had extensive soft tissue wounds and, in addition, bone injuries. Amputation had been necessary in three, and all patients but one were more or less completely immobilized in bed for several weeks. The time between injury and the onset of ureteral symptoms averaged 70.8 days and varied from 8 to 164 days. Five patients had bilateral ureteral colic. The onset of colic almost invariably coincided with or followed increased activity, which might be no more than the removal of a cast.

Intravenous pyelography was the most useful diagnostic procedure. In nine patients on whom cystoscopy was done, obstruction of one or both ureters was demonstrated, although it was sometimes so slight that a styleted catheter encountered very little resistance and ureteral catheterization in all but two of them resulted in the immediate passage of the obstructing material with permanent relief of symptoms. In three cases no obstructing mass was demonstrated by the x-ray nor recovered at the time of cystoscopy nor subsequently for some days. Obstructions which could be dignified by the term calculus were actually demonstrated in only four of the fourteen cases. The obstructing masses usually were loose aggregations of crystals or masses of amorphous material. Hematuria was present in all cases. Although several patients had been receiving sulfonamides for some days before the onset of symptoms, sulfonamide crystals were found in none of them.

A likely explanation, the authors say, is simply that of sedimentation of calcium phosphate either in the amorphous or crystalline state. A similar condition, often observed, exists when urine stands for short periods. This explanation, although simple, is in keeping with the findings, and assuming it to be correct, the prevention of such calculus formations should be relatively simple. Adequate amounts of fluid should be given during the whole period of immobilization, particularly, during the critical period shortly after injury. It should be remembered that fruit juices tend to produce an alkaline

Abstract of an article by Major W. F. Leadbetter, M. C., and Captain Henry C. Engster, M. C., submitted to the Journal of Urology for publication.

urine which is undesirable in these cases. Active movement in bed should be encouraged. Patients should be allowed to sit up and get up as early as possible. Patients in body casts or with spinal cord injuries should be turned every two or three hours and if possible the head and upper portion of the body should be elevated for periods of each day to assist in emptying the renal pelvises. The authors believe that acidifying drugs should not be given early after injury as they tend to increase the mobilization of calcium and phosphorus from bones; later, in some cases, soft calculi may be dissolved by maintaining an acid urine by giving acidifying drugs by mouth.

INHALATION ANESTHESIA IN THE TROPICS

In spite of warnings before coming to this climate about the difficulties that would be encountered in the administration of ether, this type of anesthesia still remains the one of choice. Chloroform was used for the short surgical procedures. Of course, pouring ether in the tropics is decidedly different from giving ether at home in the States. With a room temperature well above the boiling point of ether (96° F.) it was

Extract from a paper on "Anesthesia in the Tropics," by Captain Edward Darmarjian, M. C., in the Field Medical Bulletin of the China, Burma, India Theater, May 1944.



Underground surgery room protected from anything but a direct hit by shell or bomb. Bougainville Island, 1943. Signal Corps photograph.

soon learned that if the ether was kept on ice until just previous to the start of surgery, most of the evaporation was prevented. Empty rubber-stoppered plasma bottles with two double pointed needles which usually come with the plasma sets, inserted into the rubber stoppers, served as ether containers. The adequate supply of artificial ice helped considerably to remedy this problem. Of more concern than the evaporation of ether was the condensation of the patient's breath on the gauze in the mask. The patient's exhaled air, on striking the cold ether mask, would quickly saturate the gauze with water and make the vaporization of the agent too slow to be effective. Unless the gauze in the mask was changed occasionally for a fresh dry piece, it was impossible to get the patient beyond the second stage of anesthesia. For this reason, more than the usual quantity of ether was required for induction and maintenance of anesthesia, rather than the loss by evaporation as commonly believed. A cool storage place for the ether is adequate if refrigeration is not available.

ANT CONTROL

The use of a weak poison that ants will carry back to the nests is most effective. They in turn feed it to the queen and young and thus destroy the entire colony. A formula for such poison is: water, 1 pint; sugar, 1 pound; arsenite of soda, 125 grains; and tartaric acid, 25 grains. Mix and boil until the arsenite of soda dissolves. The addition of a tablespoonful of honey will attract ants more readily. Place the poisoned syrup in shallow containers accessible to the ants. Cardboard pill-boxes waterproofed inside with hot paraffin, clean tin salve boxes with small holes punched in the lid or sides, or small glass mayonnaise jars with holes in the tin cover make good containers. A sponge or a little excelsior placed in the container will help the ants to reach the poisoned syrup.

Certain types of small red ants will not accept the above formula. In such cases the following formula is suggested: water, 1 pint; sugar, 1 pound; honey, 3 ounces; thallium sulfate, 27 grains; and tartaric acid, 15 grains. Mix and stir vigorously while heating to the boiling point. Many of the larger black ants refuse syrup but will accept fat. They must be controlled by scoring a piece of ham rind on the inside and covering with the syrup, or small amounts of tartar emetic may be worked into pieces of grease or bacon rind and exposed where they will have access to it. Sodium fluoride dusted along their runways is also effective.

Attention is invited to Circular 342, "Ants and Their Control in California," University of California College of Agriculture, Agricultural Experiment Station, Berkeley, California.

From the monthly Medical Bulletin, Headquarters, Ninth Service Command, Fort Douglas, Utah, September 1944.

ACUTE ACROMIOCLAVICULAR DISLOCATION

A number of men sustaining a dislocation of the outer end of the clavicle have a persistent disability following the usual methods of treatment. A method of immobilization which gives adequate fixation, devised by Major Eugene P. Legg, has been reported to The Surgeon General's Office by Lieut. Colonel Percy M. Girard.

This fixation consists of a Velpeau-type bandage of plaster of paris, which is put on and allowed to dry. The wrist portion of a rubber glove, which is sewed at either end to a web strap, is placed over the shoulder and incorporated in the cast from the front side. A similar web strap, attached to a buckle, is incorporated in the back side of the plaster. After this plaster fixation is dry over the straps, the rubber glove is pulled tightly over the shoulder and the web strap attached to the buckle. The buckle is placed posteriorly in order to prevent the patient from loosening the strap. This apparatus holds the clavicle down and the shoulder up.

At present this fixation is being maintained for six weeks, and the results have been much improved since this prolonged fixation method has been in use.



FIGURE 1. Apparatus for maintaining reduction of dislocated acromioclavicular joint.

BAL IN OIL INTRAMUSCULARLY

BAL, the active ingredient of BAL ointment and BAL eye ointment, is now available in a form suitable for intramuscular injection. This new preparation is BAL in oil prepared in ampules, Med. Dept. Item No. 1088500. It is used specifically in the prevention and treatment of systemic poisoning caused by lewisite and other arsenical blister gases.

The use of BAL in oil does not preclude the necessity for self-decontamination. This procedure still remains an individual responsibility except for those casualties who, because of other complicating injuries, are unable to accomplish it. BAL in oil is of no value in treating or preventing pulmonary infections which may arise in the damaged respiratory tract. Specific details for the use of BAL in oil are described in War Department Technical Bulletin TB MED 101.

DAYS LOST BECAUSE OF VENEREAL DISEASE*

The following table presents the number of days lost per 1,000 men per year because of venereal disease in the nine service commands in the zone of the interior during the first seven months of 1944. The figures reflect both venereal disease rates and average days lost per case of venereal disease.

	Jan.	Feb.	Mar.	Apr.	May	June	July	Average
<i>Service Command</i>								
1st	474	402	365	329	292	292	292	349
2d	876	840	694	475	475	365	402	590
3d	949	876	730	511	438	365	438	615
MDW	475	401	401	401	401	401	475	422
4th	584	475	329	292	219	256	256	344
5th	767	840	657	548	511	584	584	642
6th	511	584	511	365	402	329	365	438
7th	657	621	475	292	255	255	255	401
8th	438	402	365	329	255	255	219	369
9th	548	511	402	255	292	292	292	370
Total U. S.	584	548	438	347	303	296	292	401

The effect of improving therapeutic methods and duty status treatment on time lost per individual case of venereal disease is shown by the following figures: the average number of days lost per case in 1939 was 42; in 1940 it was 32; in 1941, 22; 1942, 14; 1943, 10; 1944, January to June, 7.

It is anticipated that the introduction of initial penicillin treatment of gonorrhea, especially when it is carried out on a nonhospitalized status, will result in a further decline in the noneffective venereal disease rate and the time lost per case.

RELIEF OF DENTAL OFFICERS FROM ACTIVE DUTY

The Dental Division of The Surgeon General's Office states that, according to a letter from The Adjutant General's Office, 29 September 1944, several hundred dental officers will be relieved from active duty, in the following order:

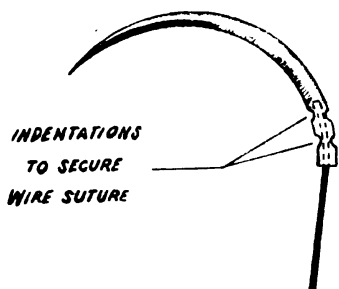
1. Those physically incapable of a full day's duty.
2. Those who require special considerations as to climate, diet, and type of work.
3. Those who may be relieved from active duty under current War Department policies.
4. Those who may be released with the least detriment to the service.

Officers are *selected* for relief from active duty in accordance with the provisions of the letter cited above and W. D. Circular No. 341, 19 August 1944. There are no directives at the present time which permit a dental officer to initiate such a request.

*From the Venereal Disease Control Division, Preventive Medicine Service, Office of The Surgeon General.

ATRAUMATIC TANTALUM WIRE SUTURES FOR PERIPHERAL NERVES

Tantalum wire in spools can be easily fastened on atraumatic needles in sutures of any desired length. Large numbers of atraumatic needles, both cutting and taper joint, are discarded after use in surgical operating sections. The remaining suture, silk or catgut, can be removed by heating the needle. Major Charles L. Neill, M. C., suggests that, to avoid losing the temper at the point, the needle be held with pliers and a small piece of wet cloth be placed over the point. The shank heats to a red glow quickly, burning out the remaining catgut or silk material.



The wire is inserted into the hollow opening of the needle shank. The shank is compressed about the wire with the cutting blade of wire pliers. This should be done carefully to avoid cutting through the needle. Two compression points will hold the wire more securely.

This method of preparing a suture will leave the needle shank indented. This is presented as a substitute for factory-fastened tantalum sutures in neurosurgery. Both 0.005 and 0.003 inch wire can be used. Atraumatic suture can be prepared easily in this manner. The smaller sized needles are useful for this purpose.

EXPERIMENTAL PRODUCTION OF HEPATITIS*

Although infectious hepatitis has become a military problem of major importance, its natural mode of transmission is unknown. Experimentally, hepatitis has often been produced by parenteral inoculation of serum from hepatitis sources into human subjects. The present report describes four definite examples of the clinical disease induced by feeding material containing an icterogenic agent.

"Infectious" materials employed in this experiment were obtained in 1943 from American and British soldiers in Africa and Sicily. Sera and fresh stool were kept at dry-ice box temperature for eight months. The dehydrated Seitz filtrates of urines and stool extracts were kept at room temperature or icebox temperature for four months. Both sera and the dehydrated Seitz filtrates of urine and stool extracts were sterile on culture before use. Stool B contained no pathogens.

*Abstract of a preliminary report by Major W. P. Havens, Jr., M.C., and Drs. Robert Ward, V. A. Drill, and John R. Paul, from the Section of Preventive Medicine and the Department of Pharmacology, Yale University School of Medicine, representing work done for the Neurotropic Virus Disease Commission of the Board for the Investigation and Control of Influenza and Other Epidemic Diseases in the Army, in the Preventive Medicine Service, Office of The Surgeon General.

The experiment consisted of administering certain of these materials to two groups of human volunteers located in two different institutions.

The first group of eight men has been observed for 106 days. Five of them were inoculated intracutaneously with serum known to contain icterogenic agent. Of these, three have contracted infectious hepatitis with moderately severe clinical jaundice in two and mild jaundice in the third after 56, 65, and 70 days, respectively. The remaining three volunteers were *fed*, and given, intranasally, serum containing icterogenic agent; they have all remained well. No other cases of infectious hepatitis occurred in this institution during the period of observation.

The second group of eleven men has been observed for 69 days. They were divided into three sections of three men each, with two kept as controls. One section of three men was fed and given intranasally sera suspected to contain icterogenic agent. Of these, two contracted infectious hepatitis with severe clinical jaundice 30 days after feeding; the onset was abrupt with chill, fever, and constitutional symptoms in each. From the blood of one of these men an organism of the *Salmonella* group was cultured during the early stages of his jaundice. His stool contained no pathogens. The blood of the second remained sterile, and his stool has contained no pathogens.

Another section of three men was fed dehydrated Seitz filtrates of urine and stool extracts of patients in various stages of infectious hepatitis *plus* stool B. Of these men, two contracted hepatitis, one with severe and one with moderate clinical jaundice 20 and 22 days, respectively, following feeding. From the blood of one man *Salmonella choleraesuis* was recovered. His stool contained no pathogens. The blood of the second patient of this group has remained sterile and no pathogens have been found in his stool.

The third section of three men was fed the dehydrated Seitz filtrate of urine and stools of patients in various stages of acute hepatitis. All of these patients have remained well.

The two controls living in proximity to the other members of the experimental group have also remained well.

It is to be noted that *S. choleraesuis* was isolated from the blood of two of the four experimental cases induced by feeding icterogenic agent. The increased severity of the clinical picture in each was compatible with that of a paratyphoid infection. It is presumed that this organism is a secondary invader in that many *Salmonella* infections had been present in one of the two institutions, where these men were quartered, prior to the beginning of the feeding experiment. It recalls observations on the correlation of *Salmonella* infections and acute hepatitis which are well known in medical literature.

One case of "naturally acquired" disease appeared among the institutional personnel 51 days after the beginning of the experiment and 31 days after the appearance of the first experimental case. It is difficult to understand why others in much closer contact to the experimental patients have not contracted the disease. It is as yet too early to postulate the exact significance of these events.

SILICATE CEMENTS

Reports received from certain stations indicate that difficulty has been experienced in using silicate cements when the powder or liquid of S. S. White and L. D. Caulk manufacture has been interchanged. A series of tests were performed with this material at Walter Reed General Hospital where it was found that if the following rules are followed, acceptable silicate fillings can be produced:

1. Read directions of the manufacturer and follow the instructions.
2. Glass slab and all instruments must be free from all contamination. Keep a separate slab and instruments for silicate cements and do not use them for any other purpose.
3. Attempt to keep the slab temperature as near 70° F. as possible.
4. The silicate liquid is the variable item; its desirable qualities readily change if exposed to air. The water content of the cement liquid is very important and cannot be varied greatly without unbalancing the reaction between the powder and the liquid. Humidity plays an important part; therefore, keep the liquid bottle clean, the neck and cap dry, free from crystals, and when not in use securely corked. (NOTE: A bottle of silicate liquid contains approximately 225 drops. It requires, under favorable conditions, at least six seconds to open the bottle, remove the pipette, and place three drops on the slab. It would take seventy-five withdrawals from the bottle to utilize all the liquid, or an exposure of seven and one-half minutes for the life of a bottle. Add to this any carelessness in the handling of the liquid and you soon expose the liquid sufficiently to change the balance, and faulty fillings result.)
5. Do not expect to use the same technique in all climates. In hot, humid weather the normal powder-liquid ratio may set up too quickly. In cool, dry weather the reverse may be true. It is well to take these factors into consideration and incorporate less powder in the liquid at a time of high temperature and humidity and more powder in cool weather.
6. Do not place liquid on the slab until everything is in readiness for the mix.
7. Avoid spreading the mix on the slab. Confine it to a small area and do not resort to excessive spatulation.
8. The setting of silicate cement if mixed properly occurs rapidly. It is not a crystalline reaction but rather a colloidal change, similar to the setting of gelatine. Not more than three minutes should elapse from the start of the mix until the material is placed in the cavity and the matrix applied.
9. Overmanipulation or slowness in filling the cavity will produce a break in the contiguity of the mass, and the resulting restoration will fail to give as satisfactory service as it should.

From the Dental Division of The Surgeon General's Office.

SERVICE IN THE TROPICS

A report on the characteristics of men suitable for duty in the tropics and the criteria by which to select personnel in terms of mental health has been forwarded by Lieut. Colonel Baldwin L. Keyes, M. C., to The Surgeon General. The report is based on a survey of U. S. Army personnel in the Middle East and in Central and West Africa, including conferences and interviews with ill and potentially ill soldiers, with American and British officers, and with missionaries and others in these areas. A set plan of specific inquiries was followed in making the survey.

In the conclusions in this report it is said that a definite syndrome develops in northern men exposed to duty in the tropics for too long a period; that this tropical syndrome develops more rapidly in certain parts of the Middle East than in others, namely West and Central Africa and across southern Arabia, the Persian Gulf, and Iraq. There are types of men who suffer more quickly and more severely; others tolerate the unusual conditions much better.



Wounded man carried out of jungle in Puerto Rico on improvised stretcher made from bamboo poles, G.I. blanket, and rope. Signal Corps photograph.

Those who cannot tolerate the tropics well are men who have in their make-up some of the following **characteristics**:

The very blond develop skin lesions and sun sickness. The overweight suffer from heat exhaustion and plethoric states. The emotionally unstable and those with other neurotic states cannot withstand hardships. Those with poor moral tone go lower, and disturb others in their groups. Those with rigid and intolerant philosophy cannot adapt themselves to the situation. The unsociable and seclu-

sive do not get on well with their comrades or the natives. Those lacking in initiative and drive depend on all the rest to look after them. Those with poor mental or physical history in family or self are likely to break under the strain.

Those who tolerate tropical conditions best are men who possess most of the following characteristics:

Pigmented skin—the type which tans easily; lean or strong build; age under 35 years; good emotional stability, moral tone, and character; tolerance and adaptability toward changes in environment and people; sociability and friendliness; initiative, imagination, and resourcefulness; ability to plan things to do when work is slack; sufficient intelligence to carry out assigned individual tasks and to care for themselves in every way when alone; self-discipline, making it possible to live in accordance with all necessary precautions against tropical diseases; ability to retain perspective of need for continuing war and to recognize their part in accomplishing this fact; good mental and physical history in family and self.



Litter bearers returning to the front after carrying wounded back to aid station on Bougainville. Signal Corps photograph.

The report notes a tendency to lose perspective in relation to the war by all men in isolated areas, particularly in the tropics. Not only individuals but groups begin to feel increasingly less significant and lose interest and understanding of the reasons why they are where they are. These factors lead to frustration, anxieties, and emotional disturbances and seriously menace the mental health of men isolated in the tropics.

The changes reported noticeable in men too long in the tropics are a composite of all the discussions and are based on an almost complete unanimity of opinion in widely different areas and different circumstances.

The physical condition of such men is said always to be impaired, many have chronic dysentery or other disease, and almost all show chronic fatigue states.

They appear listless, unkempt, careless, and apathetic with almost masklike facial expression. Speech is slow, thought content is poor, they complain of chronic headaches, insomnia, memory defect, feel forgotten, worry about themselves, are afraid of new assignments, have no sense of responsibility, and are hopeless about the future.

The time required to develop the more severe syndrome varies with the individual and the area in which he is located. Changes may be seen in three months in small isolated units in the desert or jungle across Central Africa, while in larger units closer to towns they may go on for six months to a year. Even in the larger communities, the continued heat and other factors show their effects within twelve to eighteen months.



Medical clearing station in a Pacific area.

Prognosis varies with the severity of the condition. Most cases recognized early enough to be sent off promptly recover reasonably well. Cases with pronounced mental changes, it is said, may never completely recover, but retain some evidence of memory defect, disorganized thinking, lassitude, and indifference.

Treatment

The treatment of this tropical syndrome is said to be:

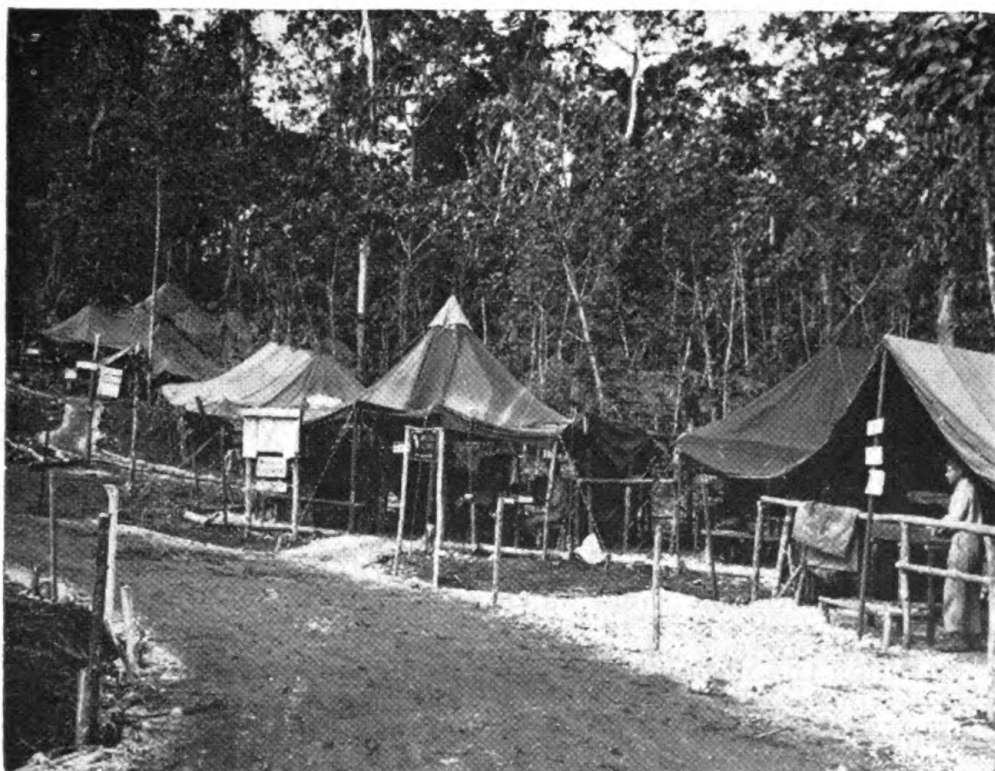
1. Frequent routine rotation within the theater.
2. Routine rotation to other than tropical areas.
3. Prompt removal from the tropics with the first indication of trouble.

4. Proper selection of personnel for duty in tropics.

5. Adequate and repeated evidences of need for the job assigned as part of war effort.

6. Readjustment on the basis that the situation of the soldier in the tropics is entirely different from that of the civilian who has a progressive, active job, a fixed rotation policy, and a schedule adjusted to the native tempo; or from that of the missionary, also on a fixed rotation basis and who has in addition a driving motive for his stay in the tropics and the compensation of an opportunity to create a new world about him.

7. Education in reference to the country and area in which men are stationed. This should include history, geopolitics, and sociologic, anthropologic, botanical, and other matters of interest to associate in a live way local problems with world problems.



Medical clearing station in a Pacific area. Signal Corps photographs.

THE INDICATIONS CONFERENCE IN GENERAL HOSPITALS

The professional staff functions of Army general hospitals are important in wartime in the plan of postgraduate medical education. Although a comprehensive resident training plan is not feasible, every effort to maintain a program of academic nature should be made. Lieut. Colonel A. P. Ohlmacher, M. C., reports that on the surgical service at Battey General Hospital, this problem has been approached by streamlining the staff functions, retaining only those of unusually practical nature.

A meeting that has been found to possess almost unique value, particularly for military general hospitals, is "The Indications Conference." Originality in this function is not claimed, as it has been practiced elsewhere, notably by Dr. Arthur Steindler of the University of Iowa.

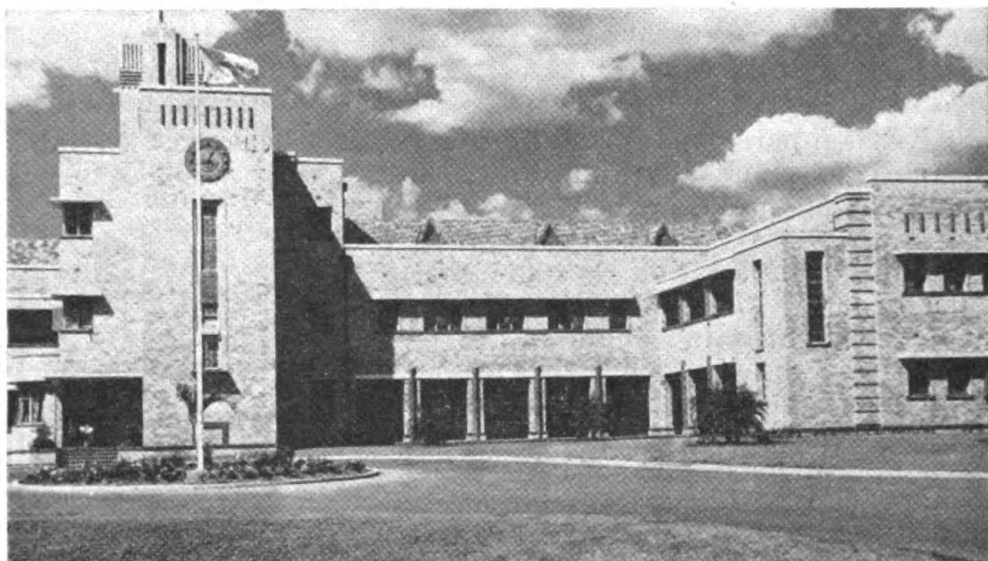
This meeting, which has attracted the interest of the entire staff, is particularly useful in training the younger men. The basic purpose of this conference is to present the reasons for and against a certain surgical approach to the case under discussion. The meeting is held in a conference room very simply equipped with chairs, blackboard, and long wooden table which may serve as an examining table for ambulatory patients or a repository for an x-ray film illuminator. Nonambulatory cases are presented on litters or, if indicated, the bed is rolled into the room. The cooperation of patients is obtained by telling them they are being brought before all the doctors of the hospital in order that the best possible plan of treatment may be determined. Thus, the skeptical soldier is impressed that he is now receiving the consideration which he deserves.

A rather delicately adjusted degree of formality is desirable. The meeting is conducted by the chief of service who should attempt to stimulate free discussion by each staff member, while discouraging excessive *sotto voce* interchanges which detract from the main theme. Cases are presented by ward officers who give in condensed form the history and clinical and laboratory findings, while the x-ray evidence may be presented at this time or later. The patient is then brought in, and after inspection and examination by the group, he is excused to allow the discussion to proceed. At this time there is an opportunity to guide the discussion into a variety of instructive channels. It may be desirable to study again the x-ray films or other diagnostic evidence. The presence of the chiefs of x-ray and laboratory services and of members of the medical service has done much to ensure a well-rounded discussion.

When the important phases of the case have been briefly and adequately covered, the ward officer presents his opinion of the indications for surgical approach and the preferred technique. Usually, his dissertation will, to some degree, reflect the attitude of the chief of section, who has become con-

versant with the case. All staff members are again invited to comment concerning the desirability of the contemplated procedure, and the healthy differences of opinion frequently result in some variation or occasionally in the abandonment of the original plan. The chief of service then briefly summarizes the discussion, in the light of which the propriety of surgical intervention has been either established or contradicted and the most appropriate procedure suggested.

This meeting creates in the various sections a lively interest in the work of the entire surgical service, and, indeed, may be of interest to the other services. There is a tendency of ward officers presenting the cases to make a thorough work-up and to ascertain that their opinions will bear close scrutiny. Since the conclusions concerning accuracy of diagnosis and the preferred surgical plan have been arrived at through free discussion, there is a minimum of opportunity for personal feeling in the event that recommendation to modify the originally submitted procedure has been made. This main-



U. S. Army hospital in Australia. This building was formerly a girls' college. Signal Corps photograph.

tains a clarified atmosphere and is valuable when doctors from divergent parts of the country, with great variation in training and experience, are thrown together during wartime. The discussions, which emphasize much that is important in surgical diagnosis and treatment, are of the greatest practical value for the entire staff and particularly for the younger men.

Included in the meetings are follow-up data such as the operative findings in recently reviewed cases, the progress of those of unusual interest, or perhaps the histologic diagnosis. The discussions do not include every case that comes to opera-

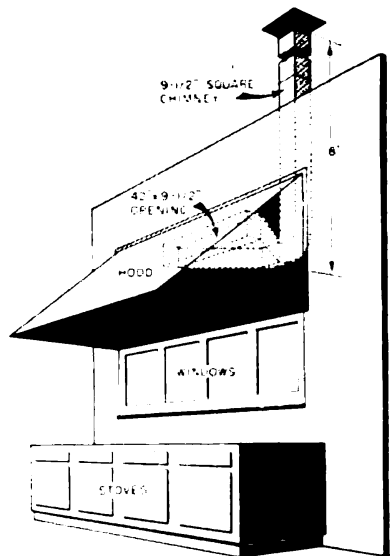
tion, but only those of an interesting nature or with equivocal aspects that may allow different avenues of technical approach. The percentage of surgical cases reviewed in the Indications Conference may vary with the total number available and the amount of time which can be spared for the exercise.

While it may be inferred that the Indications Conference, as conducted at this hospital, includes features of the Clinical Pathological Conference, the X-ray Clinical Conference, and Formal Ward Rounds, these functions are not superseded but are employed as time and material permit. The ward round remains a valuable exercise in depicting the functional characteristics of a section; however, any thorough and frank bedside discussion of a case within earshot of the patient and his bedmates includes most unfortunate psychologic implications, while a recapitulation at the end of the round, because of the confusion of data concerning several patients, fails to evolve the orderly, thorough, and conclusive consideration of the case that clearly identifies the Indications Conference.

FIELD KITCHEN VENTILATING SYSTEM

Kitchen personnel in the field have one of the least enviable of Army jobs and anything which makes their work easier is worth while. Captain Albert S. Field, Jr., M.C., writes that his unit, in a semipermanent location, has devised a hood for the kitchen ranges, which leads to a ventilating chimney. This system carries off much of the heat, lowering the temperature of the kitchen, and reduces the ill effects of heat on the personnel. Fumes and cooking odors also are greatly reduced, making mealtime more attractive and improving the morale of the unit.

The ventilating system was assembled in two days, using as material the metal lining of fragmentation bomb boxes. The hood was made large enough to cover the entire top surface of the stoves. At the top and back of the hood there is an opening 42 inches by 91½ inches. The chimney, which narrows to 9½ inches by 9½ inches, leads through a window and then vertically to a height of 18 feet. A cap was placed above the top of the chimney to keep out the rain.



From the Medical Bulletin of the North African Theater of Operations, September 1944.

METHYLENE BLUE REDUCTASE TEST IN MILK CONTROL WORK

In the item, "Quality of Milk Prior to Pasteurization," in the August 1944 *Bulletin*, attention was called to the fact that the methylene blue reductase test is only an indicator of a definite amount of bacterial activity in milk under definitely prescribed conditions and should not be expected to correlate closely with the plate count. It was also indicated that this test should be considered only as a supplement to the bacterial plate count in milk control work.

Since the publication of this item, one of our Army laboratories has compared the bacterial plate count with the methylene blue reduction time on 354 samples of raw milk received at pasteurizing plants in a large city. Of the samples compared, 180 with an average plate count of about 700,000 per ml. had a reduction time of 6 hours or over. Only 2, or slightly less than 1 percent of these 180 samples, had a bacterial plate count of 200,000 per ml. or less, while 21, or over 11 percent, had a count in excess of 1,000,000 per ml. There were 153 samples, with an average count of 1,374,000 per ml., which had a reduction time of less than 6 hours but not less than 3½ hours, and 21, with an average count of about 2,743,000 per ml., which were reduced in less than 3½ hours. Of the 153 samples with a reduction time of less than 6 hours but not less than 3½ hours, 100, or over 65 percent, had a bacterial count in excess of 1,000,000 per ml., and 3 of the 21 samples which reduced methylene blue in less than 3½ hours had a count under 1,000,000 per ml.

These results show the fallacy of relying entirely on the methylene blue reductase test for control work. They also show that Type II, No. 1, or Grade A milk may not be obtained where a reduction time of 6 hours or more is solely relied on to select milk with a bacterial count not exceeding 200,000 per ml. prior to pasteurization. They further show that a reduction time of 3½ hours does not assure a milk supply with a bacterial count which does not exceed 1,000,000 per ml.

FIGHTING MOSQUITOES IN ITALY

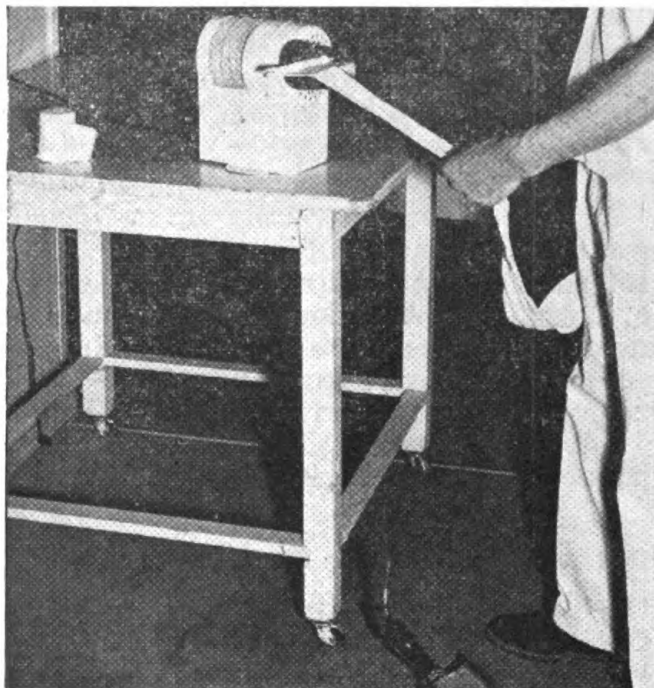
Dusting methods used in the United States to fight the boll weevil and other insects are being used in the Mediterranean Theater to combat mosquitoes in the marshlands and flooded areas of the Italian Peninsula, Sardinia, and Corsica. The present control program involves the use of low-flying planes carrying oil and insecticides. A-20 Havocs, flying not more than 20 or 30 feet off the ground, carry 3,000 pounds of dust, which require forty-five minutes to discharge. Other types of planes are used to carry oil sprays required for closely confined targets such as canals. The oil-carrying planes are fitted with four 37-gallon tanks which are discharged in one minute

or in fifteen seconds for each tank. Operations frequently are conducted in formation. In the lead plane rides a malariologist, who spots the objective. The aircraft is then deployed to hit the target.

ACE BANDAGE WRAPPING MACHINE

Ace bandages are made by a special process which requires twisting the yarn. They are elastic and special care must be taken in laundering them, for excessive heat will shorten their usefulness. Ace bandages are usually wrapped by hand at an average rate of 25 per hour. Ralph A. Nesmith, laundry foreman at the Torney General Hospital, Palm Springs, California, has devised an Ace bandage wrapping machine which will wrap 150 bandages per hour. The end of the bandage is placed in the slot of the bandage wrapping rod, then over a bandage smoothing rod. The motor, which is controlled by a foot pedal, rotates the bandage wrapping rod and thus winds the bandage.

The original machine was manually operated, cost about six dollars, and was quite satisfactory, but it was replaced by the



Ace bandage wrapping machine.

faster machine which is electrically controlled, cost about fifteen dollars for material, and was made by hand in four days. Parts needed are a 1/16 horsepower motor, a worm thread on the end of the motor shaft, a standard snap switch and a metal switch box, a screen over the switch box which provides also a flow of air through the motor, a driven gear attached to the bandage wrapping rod, housing and bear-

ing for the driven gear and bandage wrapping rod, and a wood frame box on which the motor rests and which contains the standard snap switch. This machine is still in operation at the Torney General Hospital. It is estimated that this machine saves 1,800 man-hours a year in the laundry where the bandages are rolled.

ATHLETE'S FOOT

Recent studies on the use of hypochlorite solutions for the prophylaxis of "athlete's foot" have thrown doubt on the effectiveness of this method of control. The consensus is that hypochlorite foot-bath solutions are not effective in the prevention of spread of dermatophytosis. Their failure to prevent spread of fungus infections has been attributed to various factors inherent in chlorine solutions. Of chief importance among these factors are the variable rate of decrease in concentration and limitation of range of effective fungicidal concentrations. The former factor is more or less common to all foot-bath solutions; the latter is peculiar to chlorine solutions. Limitation of range of effective fungicidal concentration is due to the following features:

1. Hypochlorous acid, the active fungicide, is not formed in effective amounts above pH 8.
2. Strong solutions of calcium or sodium hypochlorite yielding 1,000 parts per million of free chlorine have a pH above 8 and are too alkaline to form effective amounts of the active fungicide. While the use of this concentration would be practicable as regards maintenance, it would be ineffective as a fungicide.
3. Although dilution of hypochlorite solution produces greater dissociation, a lower pH, and more of the active fungicide, an effectively low concentration yielding 100 parts per million of free chlorine would require replenishment hourly when used by as few as fifteen men. The use of this concentration is therefore impracticable.

It seems probable that any foot-bath solution would be ineffective for the following reasons:

1. Even if foot baths killed all the free spores, a certain proportion of spores are encased in the keratin of epidermal scales.
2. Any solution which would dissolve keratin rapidly enough to be effective in killing keratin-encased spores in a foot bath would also dissolve the horny layer of the sole and produce a severe dermatitis.
3. The spores which are keratin-encased are tracked onto floors adjacent to foot baths, subsequently become freed from the scales, sporulate and then serve as the main source of reinfection.

It is therefore suggested that emphasis be placed on the following mechanical methods of prophylaxis:

1. Flushing of shower room and barracks floors with water under pressure.
2. Scrubbing of floors with brush and detergents.
3. Exposure of flooring or duckboards, when practicable, to direct unfiltered sunlight after application of the methods described in 1 and 2 above.

It is believed that more progress will be made in the reduction of athlete's foot by these means than by the use of foot baths.

From the Sanitation and Hygiene Division, Preventive Medicine Service, of The Surgeon General's Office.

DENTAL SERVICE—ACCEPTED PROCEDURES NOT EXPERIMENTATION

There is no substitute for quality in the service rendered the soldier by the Army Dental Corps. The Dental Division has on many occasions emphasized that, above all, quality and not quantity is the real objective of the dental service in every hospital, camp, or post. There are times and situations which demand an extended effort on the part of the dental officer to complete a particular assignment, but regardless of the circumstances the dental service cannot be jeopardized by permitting inferior work to leave the dental clinic.

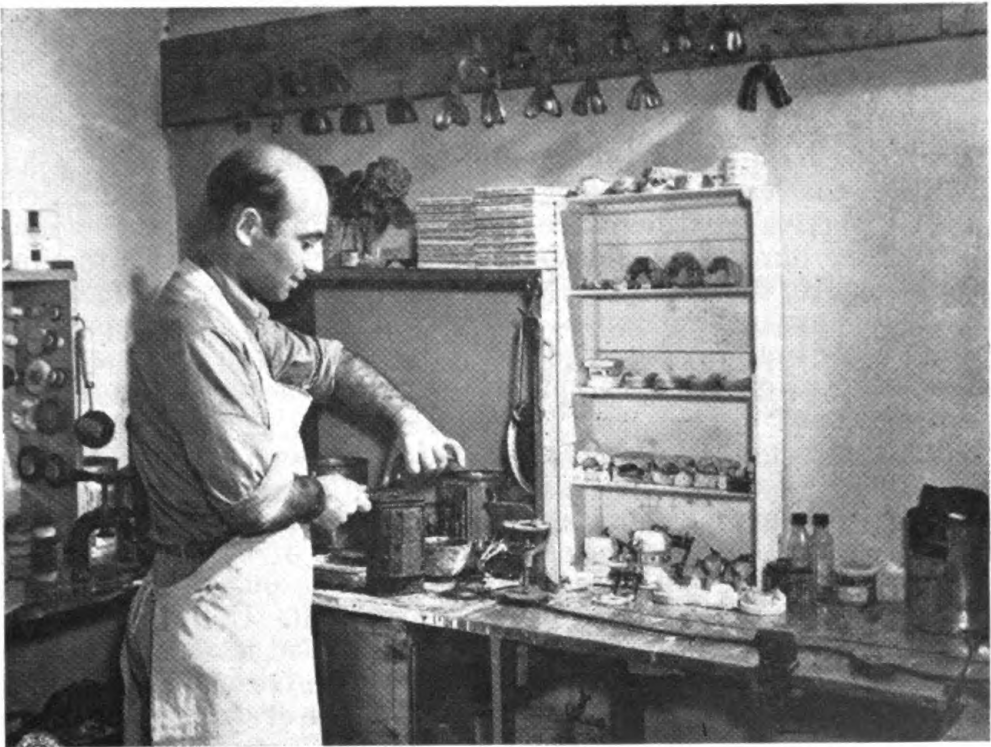
Dentistry as a profession will be measured and accepted by millions in years to come, in accordance with the attitude of the dental officer, his sincerity of purpose, and his habits as well as his abilities. A dental officer who is concerned about his future, the future of his profession, and all of the privileges gained throughout the years will try to do each piece of work a little better. Every dental officer in the service can become a better dentist, a greater asset to his family, to his community, and to society, if that is his desire and ambition. There is no reason why every officer who is placing amalgams, day after day, cannot become an expert in this phase of operative dentistry, and such special skill will pay dividends when he returns home. Generally, several improvements can be made in one's technique, and they may be recognized by extensive reading on the subject as well as by continuous observation. Although the selection and personal choice of instruments may be limited, this does not preclude the making of an excellent amalgam filling or other restorations.

The wise and progressive hospital, camp, or post dental surgeon will have organized study groups on various phases of dentistry to assure an opportunity for dental officers who are concerned about their future. Study clubs have been highly successful in civil life, and there is no good reason why progress cannot be demonstrated in a dental installation. Some officers have stated that time and conditions did not permit study groups. Where there is ambition there is a way in any fixed installation. One or two nights a week with an organized study club on amalgam, oral surgery, prosthetics, or crown and bridge will do much for any dental officer. The camp or hospital library has a fair assortment of books and journals. If this source is limited, there are the American Dental Association's facilities obtainable at 222 East Superior Street in Chicago and the slide libraries available at the Army Medical Museum, Washington, D. C.

Experimentations, short cuts, and trial techniques not proved worthy by the test of time have no place in the service rendered the soldier. The Army Dental Corps does not wel-

From the Dental Division of The Surgeon General's Office.

come or desire the dental officer to use the soldier as a guinea pig for new, "pet" ideas. The best is none too good for the man who will face enemy bullets, and a poor quality of material or workmanship may cause a dental casualty at the most crucial time in combat. Then, too, the soldier will one day return home with a G.I. amalgam, bridge, or denture. The soldier's family, the profession, as well as society at large have every right to expect a serviceable and practical restoration or denture. The soldier who has assisted in winning the war will have a great influence on public opinion and the future trends of dental practice. The farsighted dental officer will extend every effort to render superior dental service. He will permit nothing to interfere with his real obligation to society. He will recognize that he and his fellow dental officers have been given the largest public health assignment in all history. How well and completely the Dental Corps has fulfilled its mission in the war effort is known by millions, and each dental officer can evaluate his own contribution and sacrifice. The influences that the activities of the Army Dental Corps have had and will have on the health of the nation, as well as the future trends of practice and education, will be made known when the soldiers return home to their respective communities.



A dental laboratory in New Caledonia, 1942. Signal Corps photograph.

LOCAL CHEMOTHERAPY IN WOUNDS OF AMPHIBIOUS WARFARE

A review of recent reports by competent and experienced surgeons reveals a great variation in the tendency of war wounds to undergo suppuration in different theaters of war. The author attributes this variability to differences imposed by tactical peculiarities, climate, degree of soil contamination, prevalent bacterial flora, the time that elapses before initial medical care is instituted, hardships and distance of evacuation, and availability of adequate diet and nursing care. These factors, he says, may account for the differences of opinion regarding the efficacy of sulfonamides applied topically in preventing the development of wound suppuration or in controlling wound infection when once established. They may be responsible also to some degree for differences of opinion on the extent to which topical sulfonamide employment may be depended on to supplant the need for débridement. Acceptance of these assumptions implies an obligation on the part of the surgeon to recognize the particular environmental and tactical situations that confront him and to modify the application of basic surgical principles to conform to the demands of such situations.

In New Guinea and adjacent islands, the most trivial wounds are likely to be resistant to healing and frank wound suppuration is likely to appear at a much earlier time than that to which one is ordinarily accustomed. An amphibious assault on a beachhead is characterized by features which are likely to play a determinant role in formulating the pattern of medical care. A soldier injured after dark is likely to receive his initial dressing the following morning. The casualty rate tends to be highest during the first days of the assault at the small beachhead when facilities for feeding, nursing, whole blood transfusion, and general supportive treatment are likely to be minimal, factors which necessarily diminish the resistance of the wounded to infection. Furthermore, the patient may be exposed to enemy fire and have no shelter against torrential rains which may saturate not only his clothing but his dressings as well. Under these circumstances early evacuation becomes obligatory regardless of the condition of the patient.

At this stage the only means of transport are likely to be ships bearing troops and supplies, and their facilities for the care of the wounded necessarily assume a secondary role. The long distances between bases and the zones of assault in island warfare are likely to be concluded by a ride over rough jungle roads, constituting an ordeal for the patient. Under these circumstances, splints that have been well applied in forward areas are likely to become completely ineffective, resulting in great pain or even shock to the patient, and simple dressings are likely

Abstract of an article entitled, "The Efficacy of Local Chemotherapy in Wounds of Amphibious Warfare in the Southwest Pacific," by Lieut. Colonel Robert S. Sparkman, M.C., A.U.S., submitted to Surgery, Gynecology, and Obstetrics.

to become completely detached. The summation of these factors places a premium on rigid immobilization which is probably without parallel in modern warfare.

Observations on about 1,200 battle casualties from the Southwest Pacific Theater are reported with data on two groups representing two island campaigns in which dissimilar methods were used in the early handling of the wounded. One group was characterized by dependency on early use of sulfonamides, systemically and topically, the evacuation of patients in emergency splints, and the postponement of surgery in other than chest and abdominal injuries until the patient arrived at a rear echelon hospital. The other group underwent early surgery at the beachhead, followed by immobilization in plaster prior to transit. In each group sulfonamides were used topically and systemically. The average time lapse between initial injury and admission to the hospital was 3.6 days in the first group and 3.7 days in the second group. The physical and tactical obstacles to be overcome were presumably comparable in the two campaigns.

In regard to the application of the concepts noted above to the care of the wounded in amphibious operations in the Southwest Pacific Area, the author concludes as follows: There is no substitute for complete excision of all devitalized tissue from a wound, and the local application of sulfonamides should not be regarded as more than an accessory to the procedure of débridement. The importance of maximum immobilization of all wounds, whether they involve bone or soft tissue alone, is modified by the hardships of evacuation to hospitals in rear echelons; such immobilization cannot be effected safely in wounds which have not previously been subjected to adequate débridement. The necessity of such débridement is accentuated by reason of the unmistakable tendency of wounds to undergo early and extensive suppuration in this theater.

POSTWAR REFRESHER COURSES FOR VETERINARY OFFICERS

Refresher courses in many fields of veterinary medicine are being planned by practically all of the veterinary colleges in the United States for veterinary officers when they are mustered out of military service. Opportunity for clinical study may also be made available by several public clinics. Veterinary officers who may be interested in such courses should write to the institution of their choice for details.

NEUROLOGICAL EXAMINATION

Neurological Examination, W. D., A. G. O. Form No. 8-49, has been available for distribution since 30 September 1944. This new form presents a systematic outline of the organic examination of the nervous system and will replace M. D. Form 55 E-10. It is intended to be filled out completely on all patients receiving a neurological examination.

ARMY NURSES

The Army Nurse Corps had as of 27 July lost sixty-nine of its members by death in line of duty since Pearl Harbor. Twenty-four have been reported as wounded and sixty-six are prisoners of war. Six officers of the Army Nurse Corps have died as a direct result of enemy action. Other deaths have been due to accidents and disease. Some nurses have been wounded while serving aboard hospital ships and in Italy and Burma. They have suffered concussions and shrapnel and shell fragment injuries. One flight nurse in Burma was wounded when an airfield was bombed. All of the wounded have returned to duty.



First American nurse to land on French soil rolls bandages at a field hospital three hours after reaching the beachhead. France, 14 June 1944.



Nurses leaving ship on arrival in New Guinea. Signal Corps photographs.

ABSORPTION OF QUININE AND ATABRINE IN PATIENTS WITH DIARRHEA

It has been assumed that patients with diarrhea fail to absorb quinine or atabrine given orally because of increased intestinal motility, and the failure of atabrine to suppress malaria in soldiers with diarrhea has been ascribed to this idea. Since both drugs are absorbed from the upper small intestine and since atabrine actually stains the mucosa of the duodenum, it seemed probable that absorption of these drugs was not likely to be influenced by diarrhea. Accordingly, 33 cases of acute bacillary dysentery or nonspecific diarrhea were treated with atabrine and 14 with quinine. Blood levels were measured to determine whether absorption took place. Only patients with severe or moderately severe diarrhea were included in the series. The number of stools on the day of admission varied from 2 to 30.

Quinine hydrochloride, 40 grains in solution, was given daily in three divided doses for three days. Blood levels were measured on the second and third days, about three hours after the first dose of the day. Routine sulfaguanidine was given in all cases. The presence of sulfaguanidine in the blood was found not to interfere with the determination of quinine. The average level of quinine in the blood of patients with diarrhea was found to be 9.6 mg. per liter of blood, and in malaria patients without diarrhea on the same schedule of treatment the average level was 8.7 mg. of quinine per liter of blood. The average levels were comparable in patients with and without diarrhea.

Fourteen patients in the atabrine series were given 0.3 gm. t. i. d. the first day and 0.2 gm. t. i. d. the second day. Blood levels were measured on the second day, about three hours after the first dose of that day. These patients, who received routine sulfaguanidine in addition to atabrine, had an average blood level of 99 gamma per liter. Twenty-one patients were given 0.3 gm. atabrine t. i. d. the first day, and the blood levels were measured the next morning. These patients received no sulfaguanidine. The average blood level attained was 83. The difference between the two groups is not significant in view of the fact that no atabrine was given on the second day in the latter group. It is seen that considerably higher levels were found in patients with diarrhea. No patients were available who were taking sulfaguanidine but no atabrine. However, blood levels were measured on two patients taking suppressive atabrine (0.6 gm. per week) who had completed one day of sulfaguanidine therapy. Blood levels on these cases were 17 and 19 gamma per liter, which are normal suppressive levels. This indicated that the presence of sulfaguanidine in the blood did not influence the atabrine determination. Therefore, the

Prepared by the Tropical Disease Control Division, Preventive Medicine Service, The Surgeon General's Office, from a report by a malaria research unit working in the 3d Medical Laboratory overseas.

high atabrine levels in patients with dysentery seemed to represent a true increase.

Those patients having six or more stools per day were found to show levels of quinine and atabrine in the same range as those with fewer stools.

The conclusion was that quinine and atabrine are well absorbed by patients with diarrhea and dysentery.

MALARIA CONTROL POSTERS



These and other malaria control posters in color may be obtained on request to the Tropical Disease Control Division, Preventive Medicine Service, Surgeon General's Office, U. S. Army, Washington 25, D. C.

ANNUAL HISTORICAL REPORTS OF MEDICAL DEPARTMENT ACTIVITIES

Annual reports of Medical Department activities both in the United States and overseas during the calendar year 1944 should be submitted to The Surgeon General as required by paragraph 5u(2), AR 40-5, and paragraphs 4, 5, and 6, AR 40-1005. It is desired that as complete reports be submitted as the military situation permits. They should be comprehensive but concise accounts of the installation's or unit's activities, replete with illustrative details, largely narrative in style, and attractively presented. Problems and difficulties encountered should be described frankly. These reports should be submitted promptly after the close of the calendar year, if the military situation permits, and if not, they should be retained at military headquarters of the theater and forwarded as soon as practicable.

The reports are important documents for the preparation of the medical history of the war, and they are helpful also in indicating currently the necessary changes in administration, organization, supply, and training. An outline follows of some of the more important activities that should be discussed when applicable in the reports from all areas where there are no combat activities:

Date of activation and early history; function and organization; military and civilian personnel; training of personnel with training equipment, literature, and aids; equipment, supplies, and transportation; conservation of matériel and manpower; housing, water supply, bathing facilities, and laundry; food and messing, sewage and waste disposal; health of the command; insect control; venereal disease control; maneuver experience; welfare, social service, and recreation; medical, dental, and veterinary professional services; special problems and their solution; other subjects of interest.

Statistical tables are not required. Suitable photographs should be furnished, if feasible.

The reports from combat theaters of operation should include a discussion of the items listed above, when applicable, and, in addition, accounts of interesting experiences such as:

Requisitions of medical supplies, local procurement, receipt and storage, method of transportation from depots to point of use, adequacy and suitability, and difficulties and problems which were involved in the ultimate distribution.

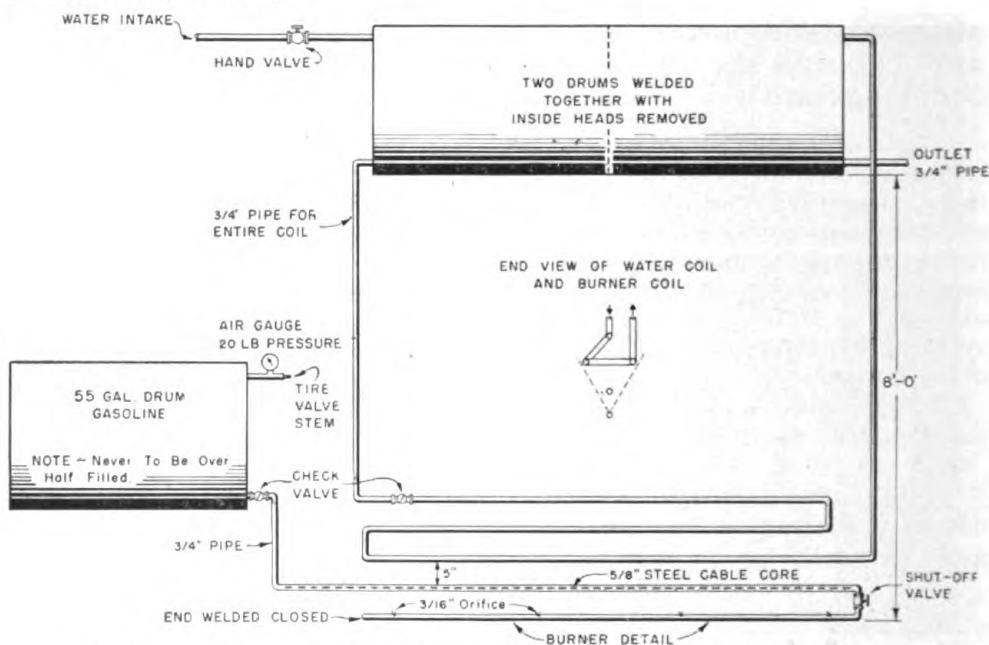
Medical service in combat, with operational maps, collection and evacuation of wounded, types and locations of mobile hospitals in relation to the combat area, etc.

The reports of combat activities submitted to The Adjutant General by Medical Department units in compliance with AR 345-105 contain valuable material. It would help if copies could be on file in the office of the theater Medical Department historical officer and in the office of The Surgeon Gen-

eral. It is suggested that the reporting officers be requested to forward two copies as sections of their annual reports, one to be retained in the office of the theater surgeon and the other to be forwarded to The Surgeon General. By this method, one discussion of medical activities during combat will suffice. Reports of critiques held after combat by division or task force surgeons should be included.

WATER HEATER

An engineer aviation battalion in the Southwest Pacific Area improvised a hot water heater by taking an oil drum and inserting a small metal tubing which connects with a distant water pipe bent in the shape of a U. After inserting a valve stem in the cup of the drum, they pumped up the pressure in the drum and drove a small spray of gasoline through the tubing into the water pipe. The heat and increased volume of the large pipe provide a favorable combustion vapor which gives a hot flame, and a $\frac{5}{8}$ -inch steel cable cord in the tubing prevents backfire into the drum. Details of the improvisation are shown in the illustration.



A few gallons of gasoline are sufficient to last many days. Nonleaded, colorless gasoline is preferable. No accidents occurred in using this heater for more than a year.

The same heaters were helpful in mess-hall operations. By cutting metal drums longitudinally and putting a heating pipe under them, water for washing mess kits could be heated to boiling in fifteen minutes. The water can be changed during shifts in the mess hall. An illustration and the description were supplied *The Bulletin* by Captain Meier Mahru, M. C., battalion surgeon.

SPONTANEOUS PNEUMOTHORAX

Eight hundred and seventy-three hospital admissions with a primary diagnosis of spontaneous pneumothorax were recorded in the Army in continental United States in 1943. In about 15 percent of the soldiers concerned the disability was considered of sufficient gravity to warrant separation from the service. The remainder, all of whom were returned to general or restricted duty, averaged about forty days in the hospital.

The treatment of spontaneous pneumothorax varies, and results are often disappointing. It is not possible to lay down specific rules, and individualization in treatment is still necessary. A bulletin of the National Research Council, prepared by Dr. James J. Waring of the Subcommittee on Tuberculosis, issued in July 1944 by its Office of Medical Information, contains information on the treatment of spontaneous pneumothorax. The following quotation from this bulletin is pertinent:

"* * * the production of an aseptic or 'chemical pleuritis' has been tried in the hope of producing adequate and persistent adhesions between lung and pleura sufficient to prevent repeated collapse of the lung. The list of chemical irritants instilled into the pleura for this purpose includes hypertonic glucose solutions (30-67.5 percent), hypertonic saline, 0.5-1.0 percent silver nitrate, glycerin, formaldehyde, oil of turpentine, gomenol in olive oil, liplodol, mineral oil, India ink, etc. Some of these preparations have been tried only experimentally. Particulate matter, such as plain or iodized talc, powdered or in suspension, has been used for the same purpose. All chemical instillations are usually painful, sometimes extremely so, often unavailing, and are frequently accompanied by more or less severe though transient constitutional symptoms and pleural effusions. Their ultimate effects are unpredictable.

"Although poudrage has been used successfully more than once, it has two great disadvantages: it places irremovable particulate matter within the pleural space and it has occasionally caused a severe pleuritis with such thickening of the visceral pleura that re-expansion of the lung was impossible. Ross and Fullerton at post-mortem found the pleura after poudrage the site of a formidable foreign body reaction about one centimeter in thickness. The patient's own blood (200-300 cc.) may be injected into the pleural space, as recommended by W. B. Porter and successfully tried by Watson and Robertson (1928) and others. Unfortunately, this method is not without danger. Organization of heavy deposits of fibrin on the visceral pleura may prevent re-expansion of the lung. (See discussion of Hemopneumothorax.) The same objection, risk of visceral pleuritis and encasement of the lung in an undistensible envelope, applies to the use of 50 percent glucose instillations. The risks of this constrictive visceral pleuritis may doubtless be minimized by resorting to chemical pleuritis only in rare instances, making the injections when the lung is on the way out, that is, not far from the parietal wall of the chest in its re-expansion, and aspirating remaining air rapidly and immediately following the chemical injection. In other words, in producing a chemical pleuritis, it is vitally necessary to get the visceral and parietal layers of pleura in contact at the earliest possible moment."

CINCHONA IN LATIN AMERICA

In "Agriculture in the Americas,"¹ William C. Davis reports that quinine supplies for the United Nations are being obtained from Guatemala, Venezuela, Colombia, Ecuador, Peru, and Bolivia, which, with Mexico, Costa Rica, and Brazil, are cooperating with the United States to develop a cinchona industry.

Cinchona was native to Latin America but was taken to the Far East and developed into a profitable plantation industry. One of the first plantings in North America appears to have been made in 1866 near Cordoba, Mexico. Cinchona plantations are now being developed in the southwest part of Mexico in the vicinity of Tapachula. Guatemala established plantations in 1865 but only a few crops have been taken from them. During the past year bark was harvested from this area by the United States in cooperation with the Guatemalan Government. Stock from cinchona seed brought out of the Philippines by Col. Arthur F. Fischer after the fall of Bataan is under cultivation in Costa Rica where ten thousand acres are being made available for cinchona.

During the past year, Colombia has contributed more bark from wild or native stands than any other country in this hemisphere. In Colombia the bark from a related plant, *Remijia*, contains quinine. The production of seedlings and establishment of plantations are receiving strong support also from the Government of Ecuador.

Japanese-established nurseries and plantations in Peru, expropriated by Peru in 1943, are being used in a project jointly sponsored by that country and the United States.

Bolivia was the source of the historic cinchona-seed collections in 1865 made by Charles Ledger and sent to the Far East, where they became the parent stock of the cinchona bark of Java. Millions of cinchona trees have been established on Bolivian plantations in the past fifteen years and bark is being taken from some of these plantations; but the chief source continues to be from native trees scattered through the Andes in the northern part of the country. The chief current contribution of Venezuela to the quinine supply is in the form of bark from wild trees.

Cultivation of cinchona began in Brazil in 1938, when the United States Department of Agriculture presented Brazil with 1,000 seedlings of the *Cinchona Ledgeriana* from the Far East. The first tablets of quinine made in Brazil recently were presented to President Vargas by the directors of the Brazilian Quinine Company of Sao Paulo.

The United States, through the Department of Agriculture and the Foreign Economic Administration, is cooperating with all these cinchona-producing countries.

1. Issued by Office of Foreign Agricultural Relations, U. S. Department of Agriculture, Washington, D. C.

ELECTROENCEPHALOGRAPHY AND NEUROLOGICAL DIAGNOSTIC TECHNIQUES

War Department Technical Bulletin TB MED 74, 27 July 1944, "Electroencephalography: Operative Technique and Interpretation," was designed to establish a uniform and standardized set of practices for use in military hospitals where electroencephalographs are in operation. Electroencephalography is now used in all neurological and neurosurgical centers and in other selected hospitals. Most medical officers who interpret the graphs and technicians who operate the apparatus have been specially selected and trained in A. S. F. courses of instruction.

War Department Technical Bulletin TB MED 76, 28 July 1944, "Neurological Diagnostic Techniques," was brought forth to standardize and delineate the generally accepted indications, contraindications, methods of performance, and interpretation of common neurological diagnostic and examination methods, spinal manometry, pneumoencephalography, and cutaneous resistance testing. The new dermatometer (Richter) has been added as an adjunct in diagnosis to peripheral nerve lesions and other neurological disorders affecting peripheral autonomic nerve supply. Exact techniques are outlined to avoid misunderstanding in future study of cases as well as in the immediate study.

MEDICAL EXPEDITION TO HOLLAND

Nine medical specialists from American medical schools and hospitals will go to Holland after that country has been liberated to give a series of four-week refresher courses in Dutch universities which have been disorganized by four years of Nazi occupation. A similar movement is under way to bring dental care to Holland. The physicians will take with them all materials and instruments needed for laboratory and demonstration purposes. The Netherlands Government will finance the traveling and other personal expenses of the specialists, who, however, will receive no extra or special compensation for their work in Holland. The specialists making the journey are: Dr. Herman de Jong, formerly of the University of Amsterdam, neurology and psychiatry; Dr. Frederic M. Hanes, clinical medicine; Dr. Keith S. Grimson, surgery; Dr. David T. Smith, bacteriology and infectious diseases; Dr. Wilburt C. Davison, pediatrics; and Dr. Edwin C. Hamblen, obstetrics, gynecology, and hormonology, all of Duke University, Durham, North Carolina; Dr. Isidore Snapper, clinical medicine, director, Department of Graduate Medical Education at Mount Sinai Hospital, New York, and formerly of the University of Amsterdam; Dr. Donald D. Van Slyke, of the Rockefeller Institute for Medical Research, biochemistry; and Dr. Eli K. Marshall, Jr., of Johns Hopkins University, physiology and pharmacology.

MUMPS AT ARMY CAMPS

The incidence of mumps among Army troops during the present war has been low. However, almost every Army post has had cases of mumps and in several the incidence has been sufficiently high to be considered epidemic. In a report¹ of an epidemic at Camp McCoy during the fall and winter of 1942-1943, references are made to mumps at other Army posts. Mumps spreads slowly through military establishments in contrast to the spread of upper respiratory tract infections in general. The subsidence of an outbreak of mumps also is slow and, once established, the disease is likely to run its course well into the spring and early summer. The peak of the Camp McCoy epidemic was not reached until the seventeenth week, when 194 cases developed, and not until nine weeks later had the admission rate dropped below 30 per week.

The personnel at Camp McCoy was about equally divided into two groups: (1) an infantry division, a large percentage of whose members came from Texas, Alabama, Tennessee, and Arkansas; (2) field artillery, engineer, and quartermaster units of the "X" Army and the post complement of soldiers from all parts of the country, predominantly from the northern and western states. In the first group, the case rate was 74.5 per thousand per annum; in the second group, it was 15.4 per thousand per annum. Eighty-four percent of all cases occurred among troops from group 1, although troops from both groups had ample opportunity to mingle. White soldiers representing 188 companies had mumps during this outbreak. Negro troops were not present at Camp McCoy during the period under study. Obviously, with 45.7 percent of its companies having only one case, the soldiers in group 2 for the most part had a high degree of immunity. In one company in group 2, which had 32 cases, almost all the soldiers came from North Carolina, South Carolina, Arkansas, and Tennessee. In the most heavily infected company, 19 percent of the men had mumps; in three companies, 14 percent; in two companies, 13 percent; and in two companies, 11 percent. Forty-five states were represented among all the soldiers who had mumps at Camp McCoy. Thirty-three percent of the patients came from Texas alone, and 71.5 percent from Texas, Oklahoma, Tennessee, Arkansas, Georgia, Alabama, South Carolina, North Carolina, and Virginia. Mumps at Camp Pickett, Virginia, Fort Bragg, North Carolina, and Fort Knox, Kentucky, occurred chiefly among Negro troops from North Carolina, South Carolina, Alabama, Georgia, and Mississippi. At Fort Lewis, Washington, Texas again headed the list, followed by Mississippi and Oklahoma. It appears that mumps in numerically significant outbreaks occurs only among groups of soldiers coming from rural areas of the South and Southwest. Furthermore,

An abstract.

1. McGuinness, A. C., and Gall, E. A.: Mumps at Army Camps in 1943, *War Medicine*, 5:95-104, February 1944.

even among the more susceptible groups, it is uncommon for as many as 10 percent of the men in one company to contract the disease in any single season.

Most of the patients without complications had little fever, and few other symptoms except discomfort from swollen salivary glands. Simple rest in bed, increased intake of fluids, and capsules containing acetylsalicylic acid, acetophenetidin, and caffeine for fever comprised all the treatment necessary. While a number of patients were given sulfonamide compounds, these drugs had no effect on the initial illness nor on the development of complications. The incidence of epididymo-orchitis was slightly over 36 percent, which is considerably higher than the incidence at some other posts. The incidence and severity of orchitis and other complications appeared to vary according to the attack rate in any given outbreak. At Camp Pickett and Fort Bragg, each of which had between 250 and 300 cases of mumps during the year, the incidence was about 15 percent; at Fort Lewis, where there were 700 cases, the incidence was 24 percent. When the attack rate is high, it seems likely that the virus is more virulent, with a resultant increase in the proportion and severity of complications. An attempt was made in a large number of cases to prevent orchitis by enforcing complete rest in bed for two weeks, but the incidence among soldiers thus treated was quite as high as among patients allowed to walk about the wards as soon as they became afebrile. While meningo-encephalitis was diagnosed by lumbar puncture in a number of cases, its incidence is regarded as much more frequent than generally supposed.

The diagnosis in a number of cases of orchitis occurring without parotitis was confirmed by complement-fixation tests made under the direction of Dr. John F. Enders of the Harvard Medical School, a member of the Commission on Measles and Mumps of the Army Epidemiological Board. In this test, the antigen consisted of a dilute suspension in saline solution of parotid glands of infected monkeys.

A promising therapeutic procedure in the treatment of orchitis is incision and drainage of the tunica albuginea, first described by G. G. Smith in 1912, and by Wesselhoeft and Vose in 1942. Orchidotomies were performed on 83 soldiers with orchitis at Camp McCoy by Captain C. F. Schroeder and Lieutenant E. J. Shumaker. The impression was that the majority of these patients received considerable relief from pain, and those who were followed one and two months subsequent to operation showed relatively little gross atrophy.

Leukocyte counts were made in 141 cases of uncomplicated mumps, 164 cases of orchitis, and 31 cases of meningo-encephalitis. The median count in the cases without complication was 5,500; in the cases complicated with orchitis, 7,700; and in the cases complicated with meningo-encephalitis, 8,700.

FEEDING HABITS OF MOSQUITO VECTORS OF ENCEPHALITIS*

In a study of the mosquito vectors of encephalitis in the Yakima Valley, Washington, a large series of blood-engorged mosquitoes, collected in domestic habitats, were tested by means of the precipitin test to determine the relative numbers which fed on domestic animal reservoirs of these infections and on man. At the same time, hand collections were made on the horse, cow, and man to determine which of the various mosquito species fed on these hosts.

It was found that *Culex tarsalis* fed frequently on domestic fowl and included most of the common domestic animals and man in its feeding range. The feeding habits of this species alone could result in the incidence of encephalitic antibodies demonstrated in domestic animals and man in the Yakima Valley. Species which were rarely or never found infected in nature appeared to be those which fed almost exclusively on mammalian blood. *Culex pipiens* was the exception as it fed almost exclusively on fowl. This species, demonstrated to be capable of transmitting only the St. Louis virus, probably plays an important role for this one virus in areas where it occurs in large numbers. The results of the precipitin tests, and the repeated isolations of virus from *Culex tarsalis* give strong support to the probability that domestic fowl are an important reservoir of encephalitic infection in the Yakima Valley.

USE OF WAX PAPER AS A SURGICAL DRESSING

The removal of surgical dressings frequently is attended by pain severe enough in some individuals to require the use of sedatives. In civilian practice and in many military medical installations in the United States the use of nonadherent substances is widespread. The lack of nonadherent substances in certain installations overseas prompted Captain Richard A. Twyman, M. C., to use wax wrapping paper from cigarette cartons, which costs nothing and the supply of which is inexhaustible.

The preparation of waxed paper from the wrappers of cigarette cartons for use with surgical dressings is simple. After the sheets are washed with soap and water, they are placed in a shallow pan and wrapped like other surgical dressings, and then sterilized in the usual manner by autoclaving. By punching holes in these sheets at $\frac{1}{4}$ -inch intervals, apertures are made to allow escape of drainage from the wound or to permit antiseptic solutions to irrigate its depths. Experience with this material in preventing adherence of surgical dressings has been gratifying in facilitating the removal of gauze dressings and in minimizing the discomfort of this procedure. There has been no evidence of harmful effects from this material.

*Summary of a paper by W. C. Reeves and W. McD. Hammon, published in The American Journal of Tropical Medicine, March 1944.

RECENT DIRECTIVES AND PUBLICATIONS

This list is intended as only a brief reference to the items mentioned. Before acting on any of them, the original communication should be read, and requests for copies, when made, should be directed to the source of the communication through proper channels.

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| <p>ASF, Headquarters
Circular No. 216
12 July 44
Part II, Sect. III</p> | <p>Printing. Sets forth administrative and financial controls established for regulation of expenditures and obligations for printing and binding by A.S.F. agencies during fiscal year beginning 1 July 1944.</p> |
| <p>ASF, Headquarters
Circular No. 217
13 July 44
Part III, Sect. VII</p> | <p>Service Command Headquarters to survey M. C. officers in key positions in regional and general hospitals and replace those not qualified for key positions held. Attaches table listing key positions.</p> |
| <p>WD Circular No. 298
14 July 44
Sect. I</p> | <p>Makes provisions re notifying relatives when insane patients are admitted to hospitals. Also makes provisions re giving adequate information re patient's condition when patient is delivered to custody of relatives.</p> |
| <p>ASF, Headquarters
Circular No. 226,
20 July 44
Part II, Sect. V</p> | <p>Nurse's Aides. Authorizes appointment of nurse's aides as paid employees by any Army hospital or dispensary where trained nurses are employed. Must be certified Red Cross nurse's aides with minimum 150 hours' service in wards of approved hospitals. Sets forth responsibility of Civil Service Commission and procedure re purchase of uniforms.</p> |
| <p>WD Circular No. 303
17 July 44</p> | <p>Redistribution stations established to obtain maximum use of personnel of A.S.F. and A.G.F. returned from overseas for reassignment by occupational and physical classification, mental and physical reconditioning, orientation, and indoctrination.</p> |
| <p>WD Circular No. 310
20 July 44
Sect. V</p> | <p>Artificial Eyes. Rescinds par. 2b(3)(b), sect. 1, W.D. Cir. No. 305, 1943, and sect. VII, W.D. Cir. No. 329, 1943. Provides that following hospitals are authorized for the furnishing of custom-made glass eyes: Dibble General Hospital, Menlo Park, Calif.; Gardiner General Hospital, Chicago, Ill.; Halloran General Hospital, Staten Island, N. Y.</p> |
| <p>WD Circular No. 312
22 July 44
Sect. IV</p> | <p>Trench Foot. Sets forth in detail causes and symptoms of trench foot and instructions to unit commanders re its prevention.</p> |
| <p>ASF, Headquarters
Circular No. 234
26 July 44
Part II, Sect. III</p> | <p>Water Supply. Makes provisions re prevention of hazards to health through the pollution of drinking water supplies at ports.</p> |
| <p>WD Circular No. 313
24 July 44
Sect. III</p> | <p>C.O.'s of Army hospitals to report tuberculosis cases to state health departments as provided in par. 44, AR 40-1080. C.O.'s of induction stations will also report cases of tuberculosis diagnosed at their stations. Sets forth data to be included in reports to state health department.</p> |
| <p>ASF, Headquarters
Circular No. 236
27 July 44
Part II, Sect. IV</p> | <p>Medical Abbreviations. C.O.'s of each station, regional station, and general hospital to prepare list of abbreviations and their meanings which have been used by medical officers in completing clinical records at their hospitals. Lists to be collected by service command and forwarded at one time to reach the Office of The Surgeon General by 31 August 1944.</p> |

- AR 40-75
24 July 44
Ambulances. Makes provisions re special equipment, classification and assignment, uses, control, and chauffeurs of ambulances. Provides that airplane evacuation will be used in accordance with directives of W.D. and C.G., A.A.F.
- AR 605-12
C 1
24 July 44
Revises regulations relating to promotions. Provides that time in grade for promotion to captain will be 9 months; major, 12 months; lieutenant colonel, 15 months; and colonel, 18 months. Service outside continental limits of U. S. will be counted as time and one-half.
- GAO Daily Synopses
of Decisions
25 July 44
B-43367
The holding by a retired Army officer of a civilian Government position became invalid on the date the salary attached to the position equaled \$2,500 per annum, and the salary paid to him in such position after that date must be refunded by him.
- AR 345-470
C 5
27 July 44
Provides that in preparing discharge certificate of enlisted man who has been transferred to station complement or detachment of patients at a hospital, or to a separation center, for purpose of discharge, the enlisted man's last permanent organization from which he was transferred for purpose of discharge will be shown. Also makes provisions re entry of "Battles, engagements, skirmishes, expeditions" on discharge certificate.
- ASF, Headquarters
Circular No. 244
1 Aug. 44
Part III, Sect. XII
Staff divisions and chiefs of technical services will reduce number of field visits by officers of Hq., A.S.F., to service commands, and Class I, II, and IV installations by 50 percent of those made during July. Requires monthly report by technical services to Chief of Staff, A.S.F., on number of field visits.
- WD Circular No. 316
20 July 44
Sect. III
Provides that W.D. pamphlet No. 21-4A, "Additional Information for Soldiers Going Back to Civilian Life," will be distributed in accordance with instructions set forth at regional and general hospitals and certain other installations.
- WD Circular No. 316
20 July 44
Sect. VI
Sets forth instructions for packing material for shipment at all posts, camps, stations, and ground and air force units.
- WD Circular No. 319
1 Aug. 44
Sect. VI
Provides that civil affairs officers be not committed to a longer period of service than other officers, after hostilities have ceased.
- ASF, Headquarters
Circular No. 249
4 Aug. 44
Part II, Sect. III
Effective 15 Aug. 1944, all medical installations used for reception, processing, definitive treatment, or disposition of patients from overseas will submit to Medical Regulating Officer, S.G.O., Room 4D-667, The Pentagon, a daily telegraph or teletype report indicating available beds for reception of patients.
- ASF, Headquarters
Circular No. 250
5 Aug. 44
Part II, Sect. III
Effective 5 Aug. 1944, an Army general hospital is established at Fort Lewis, Washington, as Class I installation of 9th Service Command. Such general hospital to absorb five station hospital facilities at Ft. Lewis.
- ASF, Headquarters
Circular No. 230
24 July 44
Part II, Sect. V
Refers to A.S.F. Circulars re assignment of enlisted men and officers found physically qualified for limited duty and who elect to remain in service. C.O.'s of hospitals authorized to communicate directly with A.S.F. and A.G.F. installations to secure direct assignments for patients prior to their release from hospitals.



The largest evacuation hospital in France on 24 July 1944.



U. S. Army nurses "off duty" at evacuation hospital in India. After completing their work at the hospital, they go shopping in town. The soldier truck drivers always give them a lift. Signal Corps photographs.

FOOD IN THE BURMA JUNGLES

Jungle chickens gather from November to February in old rice fields and often are seen in flocks scratching in straw piles where grain has been threshed. They will not come to a call except in the mating season, from the first of March to the end of May. The call is made by using a small blade of grass, held firmly between the thumbs, and mimicking the cackle of the hen. This will bring the cocks at all hours of the day. Jungle fowl also frequent banyan trees in fruit, picking up the fallen berries. In the fall they gather in flocks in sections where there are oak trees to pick the acorns. When a cock is heard crowing in the evening, go to the spot early the next morning, for he will still be in the tree or nearby.

The silver pheasant lives in heavily wooded ravines or in jungles where there is not much undergrowth. It is necessary to wait in places where there are signs of scratching. They will come to fruit trees, especially mulberry, and will leave their deep jungles in the fall in search of acorns. They can be decoyed by twirling a feather to imitate the drumming of the cock. The white feathers of the cock are easily seen on the ground where a number of feathers and white dung marks indicate a roosting place, and if one waits till nearly dark, the birds can be shot as they return.

The pigeons and the golden hornbill are fruit-eating birds. When in the jungle, the best place to find these birds is in a large banyan tree that is in fruit. One can tell where they are by listening to the chatter of smaller birds. A banyan tree is the best place to obtain a meat supply of both birds and small animals.

Peafowls are plentiful in all pine country. Like the jungle fowl, the peafowl will come down to the straw piles and scratch in the fields which have just been harvested. There is no way to decoy them, but the cocks always give a loud call when going up to roost. They will call three or four times at fifteen-minute intervals, and if the tree or even the hill can be located, it is easy to slip up on them just at dusk; the hens, which never call, roost in the trees near the cocks.

Ducks, mud hens, and snipes are found in the plains and along the rivers. They are hunted in the same way as in other countries. The mud or moor hen and wild ducks are found in the grassy swamps and ponds, and the snipes are found in rice fields, especially after the water has been brought in preparatory to plowing. In case of need, the white egret is good eating and is plentiful in all the low areas.

In the jungle streams are clams, crabs, frogs, and prawns. The black clams are about 4 to 6 inches long and are very common in mountain streams. They are difficult to open if they

Extract from special report, Office of War Information. A previous item on this subject appeared in the Bulletin for October 1944, p. 40.

die before being prepared for cooking. The natives throw live clams, one at a time, on the coals and, as soon as they open up a bit, split them in two, then wash them and boil with salt and flavoring such as a few small onions or gingerroot. They taste something like oysters.

Crabs are found along all the small streams, in wet ravines, and in wild plantain groves where there is water. The crabs throw up a mud wall around the mouth of their holes. The small crabs can be hunted in the daytime by unearthing them, as the holes are shallow. The best method of catching the larger crabs is to hunt them after dark with a light and a sharp stick. When the crabs are out at the top of their holes, a quick poke under them to close the entrance is most successful. They can be prepared like prawns and do not require any salt. The smaller crabs are the best.

The frogs found along the streams are not true bullfrogs, but they are very good to eat. The large green frog which is found in the winter months is slow of motion and easily caught. The true bullfrog hibernates and does not come out till the beginning of the rains. These frogs are not found in mountain streams, but in the plains they are common in ponds and can be hunted with a torch at night in the rice fields along the little ridges. The natives remove the entrails and cook the whole frog, while we usually think of only the legs as being fit for use. The bullfrogs are found only from May to November but the jungle frogs are found throughout the year.

The prawns live under the stones in the stream bed and are more plentiful in deep pools. They are difficult to catch with the hands. The natives cut leafy branches from a tree, weigh them down with stones, and lower them into the pools with a jungle vine. Overnight or after several hours, they draw up the branches quickly, tossing them on the bank. The prawns which gather among the leaves are thus collected. Another method is to find a small inlet in the stream and dam the water into one course, leaving one side to drain. Before doing this the natives block the lower end of the channel with leaves and then wait till the water is nearly all out. If the channel has a few deep places, they scoop the water out with a cup or with their hands. The prawns can then be caught easily by overturning stones and leaves in the channel bed. They are broiled over the hot coals or fried and can be eaten without salt.

DENTAL EXAMINATION

The National Board of Dental Examiners will hold its next sessions for the examination of candidates in Parts 1 and 2, on 4 to 5 December 1944, in schools where there are five or more candidates. Applications should come through the deans. For information address Mr. Gordon L. Teall, secretary, Box 71, Hiawatha, Kansas.

AWARD OF TYPHUS COMMISSION MEDAL

The United States of America Typhus Commission Medal has been awarded to the following civil and military personnel:

DR. ABDEL WAHED EL WAKIL, Egyptian Minister of Health, whose citation reads: For meritorious services in connection with the work of the United States of America Typhus Commission. Ever since the arrival of the United States of America Typhus Commission group at Cairo, His Excellency, Dr. Wakil, as Minister of Health, has cooperated closely with the Commission. Through his interest and influence, facilities and opportunities were made available for the investigation of typhus fever in the laboratory and hospital, while extensive tests and new developments in methods for the control of typhus fever were made possible. The information derived from the results of these studies, conducted with the cooperation of Dr. Wakil, has been of benefit to the military forces.

BRIGADIER JOHN S. K. BOYD, R.A.M.C.: For exceptionally meritorious service in connection with the work of the United States of America Typhus Commission. From the time of the arrival of the first contingent of the United States of America Typhus Commission at Cairo in January 1943 and throughout the remainder of that year, Brigadier Boyd assisted the Commission in formulating and effectuating programs for research on typhus fever and in development of measures for control. He furnished detailed information concerning the incidence of typhus fever in British forces in the Middle East in a manner which advanced coordination between American and British procedures for typhus control. Brigadier Boyd cooperated with the United States of America Typhus Commission in clinical studies, conducted to evaluate the properties of antityphus serum. In his capacity as a member of the Middle East Supply Center (Medical Section), Brigadier Boyd was extremely helpful and cooperative in arranging for distribution of typhus vaccine throughout the Middle East. Through his generous cooperation and through his many years of experience in the field of pathology, Brigadier Boyd as a consultant aided the Commission in practically every phase of its work in the Middle East.

BRIGADIER GEORGE B. PARKINSON, R.A.M.C.: For exceptionally meritorious service in connection with the work of the United States of America Typhus Commission. During the epidemic of typhus in Naples, in the period of 20 December 1943 to 20 February 1944, Brigadier Parkinson actively cooperated with the United States of America Typhus Commission and rendered service of the greatest value in support of the typhus control program in southern Italy. Through his assistance to the Commission, measures which prevented the spread of typhus in southern Italy were greatly strengthened.

BRIGADIER RUDOLPH W. GALLOWAY, R.A.M.C.: For exceptionally meritorious service in connection with the work of the United States of America Typhus Commission. During the period of from 20 December 1943 to 20 February 1944, the critical period of the outbreak of typhus at Naples and in southern Italy, Brigadier Galloway actively supported the work of the United States of America Typhus Commission in southern Italy. In addition, he took special steps to see that the danger of typhus fever was brought to the attention of all British medical officers in the area. He initiated an active typhus control program throughout the entire military forces in southern Italy.

BRIGADIER GENERAL LEON A. FOX, U. S. Army: For exceptionally meritorious service rendered first as Director and later as Field Director of the United States of America Typhus Commission. In charge of the Commission's activities in the Middle East and North Africa since March 1943, General Fox increased the extent and value of investigations and control of

typhus fever in Egypt and in other Mediterranean countries. In positions of high responsibility his opinion and counsel had important influence upon both medical affairs and international relationships. On missions to London he further cemented and strengthened British and American effort and policy for operation with Civil Affairs in this country and abroad. In December 1943, General Fox was placed in charge of the campaign against the outbreak of typhus fever at Naples, at a time when the disease had reached epidemic proportions and was a threat to military operations. Securing full cooperation from military and civilian agencies he organized a vigorous attack upon the disease, employing all the modern principles and methods for combating typhus. So effective was the work done under General Fox that the epidemic was brought under control within a month. The achievement in controlling this epidemic of typhus at Naples and in southern Italy ranks as one of the greatest triumphs of modern preventive medicine.

AWARD OF SILVER STAR

The War Department has announced the award of the Silver Star to the following medical personnel:

TECHNICIAN FOURTH GRADE WILLIAM R. JINKS, Medical Department, posthumous. While on duty 30 March 1944, at Pitylu Island, Admiralty Group, behind advancing troops, he learned that men in the front lines had been wounded and were lying helpless under enemy fire awaiting evacuation. Although his duty required him to remain in the rear at the medical aid station, he was dissatisfied with his passive role and voluntarily proceeded to the front lines and obtained information regarding the location of the wounded. He then organized a litter squad and with complete disregard of the heavy enemy fire proceeded forward, remaining under partial cover by creeping and crawling until he reached a cleared and exposed area swept by machine-gun fire and covered by enemy snipers. Leaving the squad he crossed the open area and reached a wounded man, but as he attempted to place him on a stretcher was killed in a burst of fire from an enemy machine gun. His high sense of devotion to duty and determination to render aid to wounded is worthy of the highest traditions of the medical service.

PRIVATE DONALD E. DICKENS, Medical Department, posthumous. On 16 March 1944, at Lorengau Airstrip, Manus Island, Admiralty Group, during an intense fire fight our troops suffered casualties and although his duties required his service at the aid station in the rear, the insufficiency of litter bearers impelled him to rush to the assistance of the wounded who were exposed to enemy fire in open terrain. Without hesitancy and without regard to the extreme peril of his exposure, he crossed an open, fire-swept area to attend to a wounded man. Although he was killed by enemy fire before accomplishing his mission, his voluntary and self-sacrificing gallantry exemplifies his devotion to duty and is worthy of the highest traditions of his service.

PRIVATE CHESTERFIELD BALLARD, Medical Department, of Jayess, Mississippi. On 20 January 1944 in Italy he, an aid man, crossed a river with an infantry company and advanced over flat terrain through mine fields, barbed-wire entanglements, and withering mortar and small arms fire. Without thought of self, he skillfully administered to the wounded, assisting some to evacuation points and carrying the more seriously hurt across the fire-swept battleground to the other side of the river. Returning without hesitation after each hazardous and exhausting trip, he bravely carried on his mission. He was last seen crawling forward to the aid of another wounded man and has been reported missing in action since then.



This shows how promptly the wounded were treated in the early days of the Normandy invasion. U. S. Army medical soldiers, on the beach, transfuse a survivor of a landing craft sunk off the coast.



American medical officer in France with an airborne division and a wounded soldier whose landing was less successful than that of the officer. 12 June 1944. Signal Corps photographs.

Study of Army Diet in the Tropics

CAPTAIN ALEXANDER RUSH

Medical Corps, Army of the United States

A study of the Army dietary was made in a forward area on an island in the Southwest Pacific. The study was prompted by an increasing number of soldiers who complained of loss of appetite, weight, and energy and an increase in irritability and sleeplessness. Among the possible explanations for this phenomenon were the continued threat of enemy bombing, heat and humidity of the jungle, prolonged separation from home, isolation from civilization, and monotony of the same type of food day in and day out. Among these factors, only one, the adequacy of the diet, lent itself to objective study, and, as the most serious and frequent complaints concerned the food, a detailed study of the diet seemed to be the most practical approach to the problem of unrecognized early nutritional deficiencies. Since the consensus of the Subcommittee on Medical Nutrition¹ is that "No symptoms or physical signs can be accepted as diagnostic of early nutritional failure," no attempt was made to correlate our nutritional findings with a clinical picture. The purpose of the investigation was an estimation of the nutritive value of the food *actually ingested* in relation to that served in the daily diet.

METHOD

At the outset it was obvious that if a thorough study were to be made with the facilities at hand, only a small number of subjects could be satisfactorily handled, and the selection was limited to thirteen enlisted volunteers of known integrity and reliability. These men were representative of the majority of the command in that prior to their current assignment they had served together fourteen months overseas on a large subtropical island in the South Pacific. It is significant to this study, too, that before embarking on their current mission they were staged for four weeks in Australia where they enjoyed an almost unlimited diet of fresh meats, eggs, milk, and vegetables.

Sergeant Louis Angelone (now lieutenant), Sergeant Albert Cook, and Corporal Erwin Block rendered invaluable help in this study.

1. Recognition of Early Nutritional Failure in Infants, Children, Adolescents, and Adults, Subcommittee on Medical Nutrition, Division of Medical Sciences, National Research Council, J. A. M. A., 118:615-616, 21 Feb. 1942.

Following selection of the men, a plan to obtain the desired dietary information was initiated. Before each mess, a sergeant would go to the kitchen and obtain a full sample meal. The various servings of food were weighed, and whenever a cake or mixed drink had been prepared, a quantitative recipe was obtained. After the first week, the practice of weighing at each meal such items as cereal or bread was discontinued and an average figure was taken since the individual variations from day to day between servings of the same food had been found to be negligible. At a station near the exit of the mess hall, the same sergeant checked the servings of foods actually consumed by each of the subjects, as well as any additional foods they may have ingested between meals. This procedure was carried from 1 to 24, inclusive, September 1943. A simultaneous record of the daily temperature, humidity, and barometric pressure at each meal was obtained from the local Army weather station.

TABLE I
Comparison of average amounts provided in daily diet, recommended daily allowances, minimal daily requirements, and the average daily ingestion

	Gm. protein	Gm. fat	Gm. CHO	Mg. Ca.	Mg. P.	Mg. Fe.	Calories	I. U. vit. A	Mg. thiamine	Mg. ribo.	Mg. niacin	Mg. vit. C
As served	110.0	110.7	450.7	589.3	1,664	25.2	3,260	10,400	1.73	1.91	23.69	57
Recommended allowance	112.0	150.0	300.0	800.0	900	12.0	3,000	5,000	1.80	2.70	18.00	75
Minimal requirements	35.0			500.0	600	9.0		3,000	1.00	2.00	10.00	30
Average ingestion	83.0	81.6	303.0	431.1	1,113	17.1	2,281	4,883	1.18	1.42	17.25	37

When all the information had been gathered, the diets as served (based on a single average serving of each item on the menu) and as actually ingested by each soldier were broken down quantitatively into the component food elements of protein, fat, carbohydrate, calcium, phosphorus, iron, calories, vitamin A, thiamine, riboflavin, niacin, and vitamin C. The data for these analyses were obtained from the "Tables of Food Composition," revised edition, 1 November 1943, prepared by the Committee on Food Composition of the Nutrition Board of the National Research Council. When necessary, the values for vitamins were corrected in accordance with the "Tables of Vitamin Losses in Cooking" as submitted by the same committee and dated 12 May 1943. In this manner the approximate quantity of the various food elements provided during the day in the meals as served and as ingested by each soldier was computed.

SOURCES OF ERROR

A number of factors, inherent in our method of approach, may influence the final results. First, is the effect of normal sampling errors which can assume misleading proportions in a small series of observations. The fact that the average weight loss of the small group studied was identical with that of almost 90 percent of the enlisted men in the organization is evidence that our figures reflect the dietary status of the entire unit. Second, are the minor discrepancies in weighing the foods and totaling the values. Third, is the simple fact that, while drawing from a common source of supply, the foods served in different messes may vary widely in their preparation and palatability. For these reasons, it should be remembered, when considering the results, that the values obtained are only approximations. They indicate a trend or order of magnitude rather than an exact condition and should be interpreted in that light.

RESULTS

Each element in the diet as served* and as consumed will be considered in its relation to the Recommended Daily Allowance of the Food and Nutrition Board of the National Research Council and the Minimal Daily Requirements as established by the Pure Food and Drug Administration.

Protein. The average amount of protein provided in the daily diet (total of the three meals) was 110 gm., which is a little less than the amount necessary to provide 15 percent of the caloric value of the diet (3,260). The average daily amount of protein actually ingested was 83 gm. and equals the same proportion for 2,281 calories, the average daily intake of the soldiers under study. In only two subjects was the average daily intake of protein below the recommended 70 gm. In no instance did the average intake of any individual fall as low as the minimal level of 35 gm. The question of the proportion of animal to vegetable protein has yet to be worked out. It may prove to be significant where soldiers, through constant repetition, have acquired a distaste for such staples as canned luncheon meat, corned beef, and Vienna sausage.

Fat. The average amount of fat available in the daily diet was 110 gm. The average amount ingested was 81 gm. To meet the recommendation that 45 percent of the caloric intake be derived from fat,² 163 gm. and 114 gm., respectively, would have been required in the diets as served and consumed. Actually in both diets only 35 percent of the total daily caloric intake was furnished by fat. The physiologic significance of this reduction in terms of the sparing action of fat on the thiamine requirement will be discussed later.

*"New Guinea 'X' Ration" or normal field ration consisting of canned, preserved, and dehydrated foods supplemented by fresh fruit, vegetables, eggs, and meats, as circumstances permit.

2. Du Bois, E. F., and Chambers, W. H.: Handbook of Nutrition; Calories in Medical Practice, J. A. M. A., 119:1183-1188, 8 Aug. 1942.

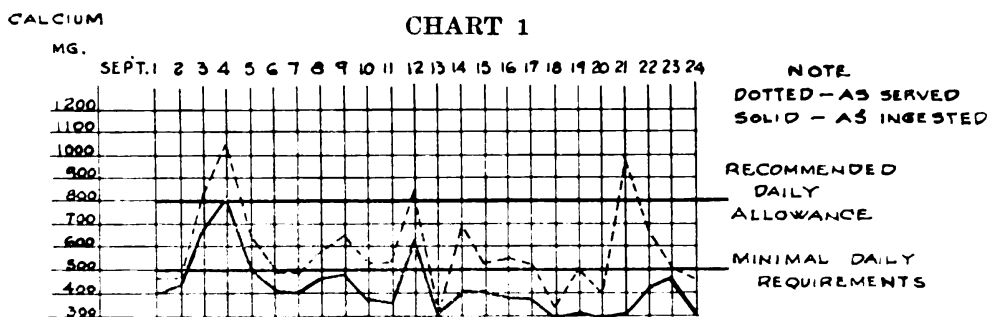
TABLE II
*Actual consumption of food in relation to the times presented
in a 24-day period*

	No. times served	Average No. of men partaking	Average in percent*
MEATS, FISH, AND POULTRY			
†Bacon, canned	22	5	41
Beef, fr. med. fat	8	12	90
Beef, canned, corned	8	8	62
Chile con carne	1	8	62
Lamb, stew, fr.	1	11	85
Luncheon meat, canned	8	9	72
Pork, fr.	1	13	100
†Salmon, canned	4	6	46
Sausage, Vienna, canned	11	11	85
Stew, meat, and veg. canned	4	9	72
EGGS			
Eggs, fr.	1	10	76
Eggs, dried, whole	5	7	55
MILK AND MILK PRODUCTS			
Cheese	3	9	72
Milk, evap. (45 cc. av.)	41	10	76
Milk (eggnog)	2	10	76
Milk (cocoa)	5	12	92
FATS AND ARMY SPREADS			
Butter, fr.	9	11	85
SUGARS AND SIRUPS			
Apple butter	3	5	38
Gelatin dessert powder	1	11	85
Jams, assort.	29	5	40
Pudding, dessert powder, choc.	4	12	94
CEREAL AND GRAIN PRODUCTS			
Bread, G. I.	50	11	86
Cereal, wheat, cooked	8	7	57
Cereal, dry, wheat	3	8	64
Cookies	1	12	92
Crackers, saltine	4	6	50
Pancakes	7	11	86
Oatmeal	10	6	50
Spaghetti	5	11	85
Toast, French	9	11	85
Doughnuts	2	11	85
Cake	7	12	89
BEANS, OTHER LEGUMES, NUTS DRY			
Beans, navy	2	10	73
Peanut butter	7	6	42
Soup, bean, pea	4	8	58
VEGETABLES, LEAFY, GREEN, OR YELLOW			
Asparagus, canned	1	12	92
Beans, string, canned	6	7	51
Carrots, canned	5	5	41
Peas, canned	5	8	62
Peas and carrots	5	5	40
Potatoes, sweet, dehyd.	1	4	30
Spinach, canned	6	4	32
TOMATOES, canned			
	3	5	36
CITRUS FRUITS			
Grapefruit juice, canned	1	12	92
Lemon juice, powd.	13	11	85
POTATOES			
Potatoes, fr.	9	10	80
Potatoes, fr. salad	3	6	50
Potatoes, dehyd.	15	4	30
VEGETABLES, OTHER THAN LEAFY, GREEN, OR YELLOW			
Beans, lima, canned	3	9	70
Beets, canned	3	9	70
Corn, canned, yellow	5	11	86
Corn, canned, fritters	2	12	91
Sauerkraut, canned	3	10	76
FRUITS, OTHER THAN CITRUS			
Apples, canned or dried (pie)	8	11	85
Cherries, canned	1	10	76
Fruit cocktail, canned	9	9	70
Peaches, pears, canned	15	9	70
Pineapple, canned	2	10	76
DRIED FRUITS			
Apricots, dried	6	9	70
Prunes	3	5	40

*Because of the very small number of men included in this study, individual whilms constantly repeated with regard to certain foods makes the percentage values only very rough approximations and of limited application.
†These values will vary greatly with the manner of preparation and particularly with the grade of the product.

Carbohydrate. The average amount of carbohydrate provided in the daily diet was unusually high (450 gm.). The average quantity ingested daily was 303 gm. The proportion of the daily total caloric intake provided by carbohydrate is 50 percent. The recommended percentage is 40 percent.² As a result, instead of the usual proportion by weight of 1 part protein to 1½ parts fat, to 3 parts carbohydrate, a ratio of 1-1-4 prevailed. Coupled with the relative decrease in the fat content of the diet, this increase in the carbohydrate ingestion has an important effect in increasing the thiamine requirement.

Calcium. The average level of calcium in the diet as served was 589 mg., which is 25 percent below the recommended allowance of 800 mg. but slightly above the minimal requirement of 500 mg. The average amount consumed in the daily diet was 431 mg. or almost 50 percent below the recommended allowance and 20 percent below the minimal requirement.



A comparison of the average quantity provided in the daily diet with that consumed by subjects tested.

Phosphorus. In contrast to calcium, phosphorus as served and as consumed averaged above the recommended allowance of 800 to 1,000 mg. and the minimal requirement of 600 mg. Available in the daily diet was an average of 1,664 mg. while the average amount ingested was 1,114 mg.

Iron. This mineral resembles phosphorus in that the average daily provision and the average daily intake were sufficient to meet the recommended and minimal allowances of 18 mg. and 10 mg., respectively. The average quantity provided in the daily diet was 23 mg. and the daily intake, 17 mg.

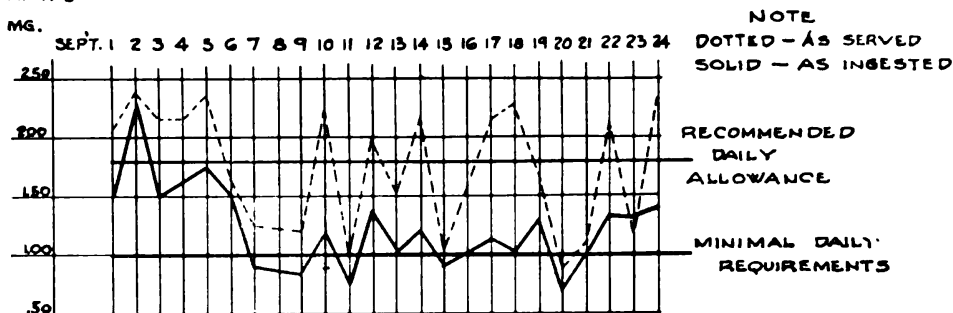
Calories. In almost every instance, the calories available in the daily dietary were above the 3,000 recommended for men of average build, doing moderately active work. The average daily provision was 3,260 calories. The average daily ingestion was 2,281 calories. During an eight-month period at this station and on a diet essentially similar to that studied, the twelve soldiers in this investigation lost from 3 to 33 lb. with an average weight loss of more than 13 lb. There were no exceptions. Under identical conditions and over the same

period, 88 percent of the parent command which included over 300 enlisted men experienced an average weight loss of 13.4 lb. Eight percent had no change in weight, while 4 percent gained an average of 6 lb. This fact indicates that, under the conditions of the investigation, the caloric intake in practically every case was insufficient to maintain normal weight, although the amount provided in the meals was adequate.

Vitamin A. The value for this vitamin in the diet assumed especial interest since it was a common belief among the Air Forces personnel subsisting on essentially the same basic ration, that the provision of vitamin A was inadequate. Analysis revealed that the average daily amount available in the diet as provided was 10,400 units, while the average daily consumption of the tested subjects was 4,883 units. This figure is almost identical with the recommended daily allowance of 5,000 units and well above 47 units per kilogram of body weight, the accepted minimum sufficient to prevent night blindness.⁸

THIAMINE

CHART 2



A comparison of the average quantity provided in the daily diet with that consumed by subjects tested.

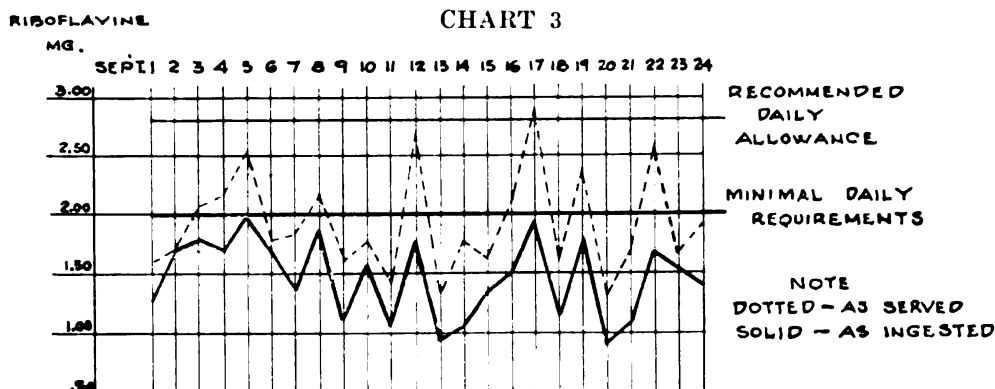
Thiamine.* The average daily provision in the diet of this important fraction of the vitamin B complex was 1.73 mg., an amount slightly beneath the recommended daily allowance of 1.80 mg. but above the minimal daily requirement of 1.0 mg.⁴ In contrast to that contained in the diet as served, the average daily ingestion of thiamine was only 1.18 mg., a figure 35 percent below the recommended daily allowance and only barely above the minimal requirement. None of the subjects studied attained an average daily thiamine intake equal to the recommended amount. Two subjects failed to consume as much as the minimal requirement. It will be shown subsequently that this meager supply and consumption is of even greater significance in the light of factors known to increase the requirement above the generally accepted level.

*It was learned subsequently that an Australian flour was used which at this time possessed less than one-half the thiamine content of the enriched American product on which our calculations are based. The correct values would thus be even lower than the ones given above.

3. Duncan, G. G.: *Diseases of Metabolism: Detailed Methods of Diagnosis and Treatment*. Philadelphia: W. B. Saunders Co., 1942.

4. Elvehjem, C. A.: *Handbook of Nutrition; Water Soluble Vitamins*. J. A. M. A., 120:1388-1397, 26 Dec. 1942.

Riboflavin. Of all the elements in the dietary, the greatest deficiencies were encountered in this fraction of the B complex. The average quantity provided in the daily diet was 1.91 mg. or about 70 percent of the recommended daily allowance of 2.7 mg.* The figure for the average daily consumption was even more strikingly reduced, being 1.42 mg. or 30 percent below the minimal requirement of 2.00 mg. Not in a single subject studied did the riboflavin intake reach as high as the minimal requirement.



A comparison of the average quantity provided in the daily diet with that consumed by subjects tested.

Niacin (nicotinic acid). This fraction both as served and as consumed showed no significant deviation from normal levels. The average amount provided in the diet was 23 mg. while the average amount ingested was 17 mg. The recommended daily allowance is 18 mg. and the minimal requirement 10 mg.

Vitamin C. The average amount of vitamin C furnished in the diet was 57 mg. while the average amount ingested daily was 37 mg. The former value is 25 percent below the recommended daily allowance while the latter is barely above the minimal daily requirement.

DISCUSSION

Jolliffe,⁶ in his discussion of malnutrition, draws the distinction between a primary deficiency arising from inadequate diet alone and a conditioned or secondary deficiency caused by factors which interfere with the ingestion, absorption, or utilization of nutrients or by factors that increase their requirement, destruction, or excretion. Our results indicate that the ground is fertile for both types of deficiency to exist simultaneously among men living on the New Guinea

*Recently it has been learned (5) that the recommended daily allowance for riboflavin has been reduced to 2.3 mg. per 3,800 calories. On this basis the average amount of riboflavin contained in the daily dietary closely approximates the allowance recommended for the calories provided. On the other hand, the average amount ingested each day is 30 percent below that level and just above the minimal requirement.

5. Bergren, W. R.: Personal communication.

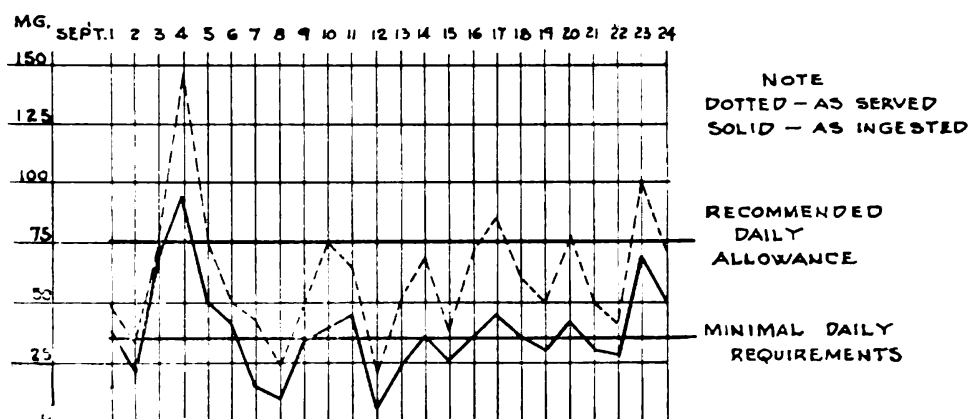
6. Jolliffe, N.: Handbook of Nutrition; Conditioned Malnutrition, J. A. M. A., 122:299-306, 29 May 1943.

"X" ration under modified garrison conditions. By "troops living under modified garrison conditions" reference is made to units stationed in forward areas at some distance from bases but not engaged in actual combat or combat patrols. Under these circumstances, the supply and storage of additional fresh foods are difficult with the result that amounts available are usually extremely limited.

The principal nutrients found to be primarily deficient in both the diet as served and as consumed were calcium, thiamine, riboflavin, and ascorbic acid. The deficiency in

ASCORBIC ACID

CHART 4



A comparison of the average quantity provided in the daily diet with that consumed by subjects tested.

calcium resulted largely from difficulty in obtaining milk and milk products which are practically the sole source of calcium in any diet. Cheese and milk, in any form but the sweetened condensed product, were always limited in supply and for long periods were virtually unobtainable. Just how important is the lack of dietary calcium alone in the economy of the adult is a moot point. Prolonged severe calcium deprivation might contribute to hemorrhagic states, but it is likely that, under ordinary conditions in the field, the body is able to mobilize from its large reserve stores sufficient quantities to compensate for deficiencies in the diet. On the other hand, a prolonged drain on the calcium reserves while unimportant in a healthy soldier might have unfavorable influence on the healing of injured bone. It is of interest that the dentists who had cared for the teeth of the organization since leaving the United States noted a gradual increase in dental caries and gingivitis. They are not prepared to say what the primary etiology is but feel that inadequacies of the diet may be a contributing factor.⁷

Strictly speaking, the provision of 1.73 mg. of thiamine in the average daily diet might appear adequate since it is

7. Heck, W. L.: Personal communication.

within 5 percent of the recommended daily allowance. From a practical point, however, the converse is true, for the amount of thiamine provided does not make sufficient allowance for the failure of the majority of soldiers to eat the full diet. Only by consuming full portions of every article of food served could they hope even to approach the recommended daily intake. How this primary deficiency of thiamine is further aggravated will be developed in discussing the secondary or conditioning factors of early malnutrition.

The riboflavin provided in the diet was not only 50 percent below the recommended allowance but 5 percent below the minimal requirement. As a result, the average daily intake of the subjects studied fell 30 percent below the minimal requirement. In spite of this low intake, no florid lesions directly attributable to a vitamin deficiency were encountered. The explanation may be that sufficient time had not elapsed for the development of the typical lesion⁸ or that the accepted values are too high.* On the other hand the possible relationship of this low vitamin intake to the high incidence of skin affections in this area deserves further consideration.

There are at least two possible explanations for the low vitamin C content in the diets as served and as consumed. First, since ascorbic acid is thermolabile, much of it is destroyed in cooking and processing ordinary foods. The burden of providing vitamin C thereby falls principally on canned fruit juices or fortified synthetic beverages. The supply of the former during this investigation was limited to one serving in twenty-four days, while the synthetic powdered lemon juice was served fourteen times over the same period. If prepared according to the recommended formula, one-half can-teen-cup full will contain 42.5 mg. of ascorbic acid. However, it was a common experience that a drink prepared in this concentration produced a disagreeable, irritating sensation in most throats with the result that the practice of adding twice as much water became standard, thus reducing the ascorbic acid content of the drink by one-half. It is doubtful whether the levels of vitamin C intake encountered are sufficiently low to produce clinical scurvy. Likewise, it is doubtful whether they would play a significant part in delaying the healing of uninfected wounds. On the other hand, it is possible that in the presence of infection, the requirement of vitamin C may be increased, thereby rendering advisable the supplementary use of this vitamin during treatment.

In addition to the basic, primary deficiency disclosed, it is likely that a number of secondary or conditioning factors enter into the dietary problem. These factors have been described by Jolliffe as those which interfere with either ingestion, absorption, and utilization or those which increase the

*See footnote, page 49.

8. Najjar, V. A., and Holt, L. E., Jr.: The Biosynthesis of Thiamine in Man and Its Implications in Human Nutrition, *J. A. M. A.*, 123:683-684, 13 Nov. 1943.

requirement, destruction, or excretion of essential nutrients. Taking these factors in order, we will discuss their influence under the conditions of our study.

Factors interfering with ingestion. Of the one-half dozen subheadings in this category, neuropsychiatric disorders are important in some cases. As a result of enemy bombing or the threat of bombing, some soldiers may develop an anxiety state, often mild but sufficient to interfere temporarily with their desire for food and their sleep. It is doubtful whether this factor played a significant role among the soldiers studied. On the other hand, if the threat had been continued for a long period of time, it is possible that the reduced intake of food secondary to this chronic anxiety might have assumed serious proportions. One soldier in our group, for no discernible reason, gradually lost his appetite, began to vomit at irregular intervals, lost weight, became anemic, and developed mild "psychoneurotic" symptoms characterized by depression and unusual concern for his bodily health. It is difficult to say whether the symptoms were the direct result of or merely accentuated by his extremely low intake of food and vitamins. A satisfactory trial of replacement therapy was never carried out and the man has been labeled a psychiatric problem.

Another secondary factor that may interfere with the ingestion of certain essential nutrients is the effect on the appetite of excessive heat and humidity. It is a common experience in the temperate zones that during the hot summer months most people consume less food than under cooler conditions. Mills⁹ found that animals at 91° F. ate only about two-thirds as much food as at 65° F.

Perhaps the most important factor influencing ingestion of food is its palatability. So-called "iron rations" are satisfactory for a short time, but the continued serving of canned products for months leads to a distaste bordering on nausea. In some instances, soldiers will make their meals on bread, jam, and coffee rather than ingest the various canned and dehydrated products.

Factors increasing bodily requirements. Among these factors have been listed abnormal environmental conditions such as excessively high temperatures in the tropics. During this study the average daily temperature at breakfast, lunch, and supper was 77°, 85°, and 81° F., while the average relative humidity was 94 percent, 75 percent, and 83 percent. Mills⁹ has stated that, with the lower combustion level of people in tropical heat, more vitamins are required to utilize each gram of food ingested than at more optimal temperatures. However, confirmation of such an environmental effect is lacking.

9. Mills, C. A.: American Health Resorts; Climate and Disease, J. A. M. A., 123:551-557, 30 Oct. 1943.

A second conditioning factor that has been shown to increase the thiamine requirement is an increase in the consumption of carbohydrates. Cowgill¹⁰ concluded that the thiamine requirement of the body is determined by the amount of glucose to be burned and that a more or less constant ratio exists between the thiamine requirement and the total nonfat calories in the diet. Our results revealed that the amount of carbohydrate provided in the diet exceeded the daily optimal level by an average of 150 gm.

Factors interfering with absorption. Achlorhydria has been listed in this category. As the observation that achlorhydria may interfere with the absorption of thiamine had not been previously noted by us, no data on the effect of tropical climate on gastric secretion were collected. However, laboratory experiments have revealed that the acid secretory response to histamine may be reduced when the body temperature is raised as little as 1° F.¹¹ It might be said that the time-honored custom of those living in the tropics to add strong spices to their foods may have a sound physiologic basis because of the stimulating action of condiments on gastric secretion.

Factors interfering with utilization. Various drugs including the sulfonamides have been listed under this heading. The soldiers studied were not receiving sulfa drugs; but since their arrival in the malarial zone, all of them had been taking 0.1 gm. of atabrine six days a week. Studies on the effect of the prolonged administration of atabrine on the utilization of vitamins have not been encountered. However, Lieut. Colonel G. G. Duncan,¹² medical consultant to the VI Army, while studying large numbers of soldiers receiving atabrine and others receiving quinine for the suppression of recurrent malaria, observed that many failed to gain weight and the majority lost weight in spite of a diet fortified with abundant, appetizing, fresh foods and dairy products.

Factors increasing excretion. Under the tropical conditions of our study, the slightest exertion induced copious perspiration, which during moderate or severe activity drenched the clothing. Cornbleet, Kirch, and Bergeim¹³ have presented evidence that as much as 5 percent of the daily thiamine intake may be lost per liter of sweat. Under ordinary conditions in a temperate climate the loss by this route is probably negligible but in the tropics where the sweat may amount to 3 or more liters per day the excretion of thiamine might be significant especially when there is an inadequate supply in the daily diet. A recent report from the Harvard Fatigue Laboratory¹⁴ suggests, however, that vitamin losses in this manner are insignificant.

10. Cowgill, G. R.: Cited by Mills, C. A., *ibid.*

11. Luckhardt, A. B., and Rush, A.: Unpublished observations.

12. Duncan, G. G.: Personal communication.

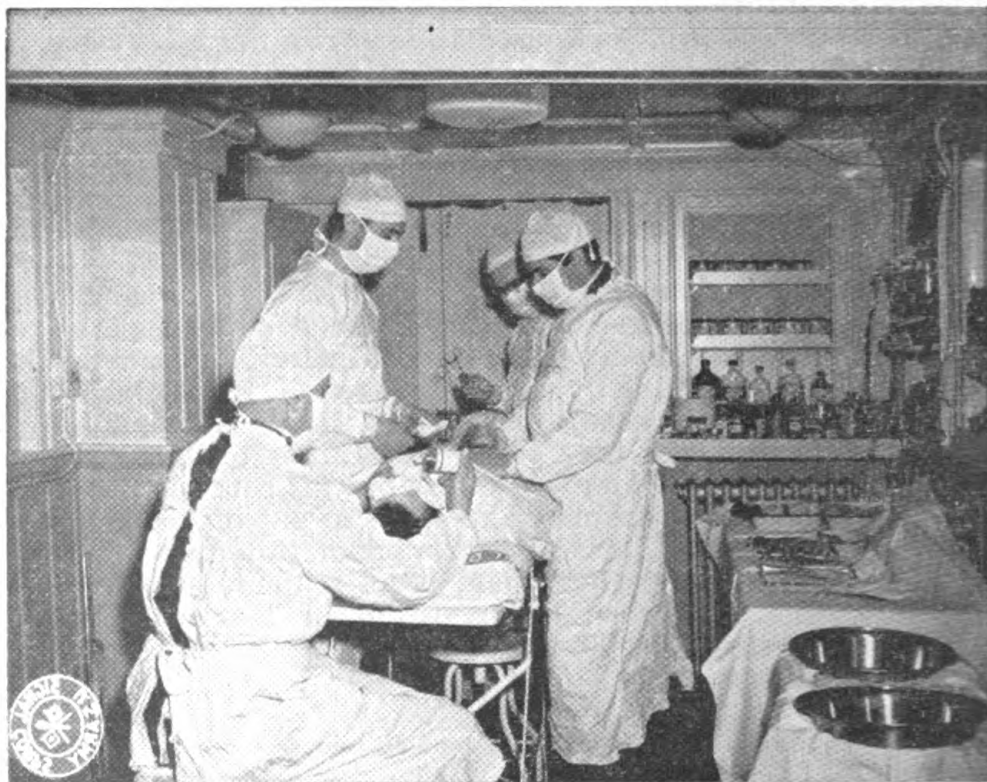
13. Cornbleet, T., Kirch, E. R., Bergeim, O.: Excretion of Thiamine, Riboflavin, Niacin, and Pantothenic Acid in Human Sweat, *J. A. M. A.*, 122:426-429, 12 June 1943.

14. Johnson, R. E.: Nutritional Standards for Men in Tropical Climates, *Gastroenterology*, 1:832-839, Sept. 1943.

RECOMMENDATIONS

A quantitative study of the diet as provided and as consumed by a small group of soldiers in a forward area in the tropics revealed primary dietary deficiencies in calcium, thiamine, riboflavin, and ascorbic acid. Studies by other investigators suggest that certain additional conditioning factors may render more acute the effects of this primary lack. The secondary or conditioning factors of importance in our studies were the influence of anxiety states, the influence of tropical heat and humidity in reducing the desire for food, the effect of palatability in reducing the intake of foods, and the increased bodily requirements incident to an unusually high carbohydrate diet.

These findings suggest that the dietary as provided to troops in the tropics be fortified with respect to the deficient elements. Such a program is said to be now underway whereby increased amounts of calcium and vitamins are being incorporated in flour and yeast. The supplemental use of poly-vitamin preparations in that case would not be advised except when circumstances indicate a failure to obtain sufficient quantities of those substances in the food eaten.



Operating room aboard U. S. Transport at Attu, Aleutian Islands, 25 April 1943.

Common Errors in Electrocardiographic Diagnosis

COLONEL JOHN T. KING

Medical Corps, Army of the United States

and

MAJOR GEORGE P. ROBB

Medical Corps, Army of the United States

The employment of electrocardiography in World War I was almost negligible. An instrument was made available at General Hospital No. 9 at Lakewood, New Jersey, to a research group engaged in the study of neurocirculatory asthenia. The first instrument to be used at Walter Reed General Hospital was installed in 1919 when demobilization was nearly complete. The contribution to electrocardiography made by the United States was initially one of rapid exploitation and application to the common good. The sale of instruments ran far ahead of the number of physicians capable of using them and of interpreting the graphs correctly. During the early years the method was used to elucidate mechanical disorders of the heartbeat and for signs of hypertrophy evidenced by "preponderance" of a ventricle in the electrocardiogram (deviation of the electrical axis). Only in the last few years have the signs of myocardial degeneration in the terminal portion of the tracing been appreciated generally. These signs today are the most valuable evidence afforded by electrocardiography.

Present-day interpretation of electrocardiograms is greatly improved over that of twenty years ago. Even if subsequent developments show them to have been erroneous, many mistaken diagnoses are defensible under the circumstances at the time the diagnoses were made.

An unusual opportunity is afforded in a large general hospital to judge the accuracy of early electrocardiographic observations. Errors that have come to our attention may be classed as mistakes of *technique* (including inadequate recording of drug therapy) and of *interpretation*. In the former category may be listed (1) poor photography, (2) lack of evidence showing standardization of tension of the string, (3) neglect in recording recent digitalis or quinidine therapy, and (4) attaching the films in incorrect sequence or upside down.

From the Medical Service, Walter Reed General Hospital.
Major G. R. McClary and Captain I. Freed assisted in collecting clinical material for this report.

TECHNIQUE

A serious error in technique is the occasional neglect in reporting on the request for an electrocardiogram recent or current treatment with such drugs as digitalis or quinidine. The extent to which such lack of information can lead the cardiologist astray is illustrated in figure 1. Some films are so lightly exposed as to be almost illegible. This is most often encountered in films made overseas, and may be due to difficulty in excluding irrelevant light from the photographic apparatus. Any improvement in this branch of technique would help the cardiologist in the general hospital in his final analysis of the case.

A common handicap in reading films transmitted from other laboratories lies in the absence of *demonstrated* standardization of the electrocardiographic string. "Low voltage" of ventricular complexes is an important electrocardiographic finding, but without recorded standardization of the string on the transfer film, one is uncertain whether the limited complexes are significant or are due merely to artifact (tight string).

Of the series of 50 unselected cases of enlisted personnel, transfer films showed normal standardization in 23; in 7 the string was "over standardized" (loose), in 5 it was "under standardized" (tight), and in 15 cases no standardization of the string was recorded on the transfer film.

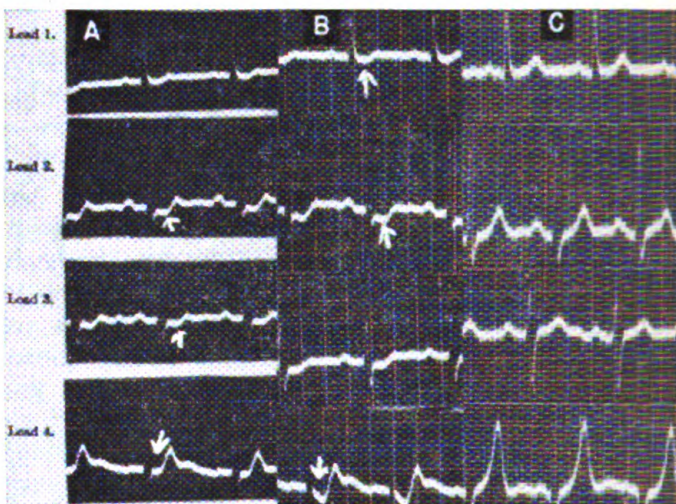


FIGURE 1. Case 12 in officer series. A, digitalis effect on S-T segments. B, aggravated digitalis effect, eleven days later. C, four months later. No digitalis. The tracing has returned to normal. Because of lack of note regarding digitalis on electrocardiographic request, tracings A and B had led to diagnosis of "posterior myocardial infarction on basis of old anterior infarction."

INTERPRETATION

Criticism has been made of the fact that a diagnosis of specified organic heart disease is sometimes made on insufficient electrocardiographic evidence, in particular, certain T wave changes. Such criticism may be justified or unwarranted according to the nature of such T wave patterns.

To obtain evidence of the quality of interpretation in various laboratories, the clinical records of 50 officers reaching this hospital from elsewhere, with electrocardiograms that had been

made and interpreted in a number of other hospitals, have been analyzed. The cases were unselected and were those of officers reaching this hospital during the first half of 1944. The results are shown in table II. We make no claim of infallibility for the interpretations made at Walter Reed General Hospital but have merely tried to determine what proportion of previous interpretations could be said to meet current conservative standards and the number of those in which the interpretation was not adequately supported by the accompanying film.

An analysis was made of previous electrocardiographic interpretations in 50 unselected cases of enlisted men transferred to this hospital with the diagnosis or suspected diagnosis of cardiac disease. In 39 of these cases the transfer interpretation was concurred in at this hospital, while in 11 it could not be confirmed. A summary showing the distribution of the confirmed and unconfirmed cases according to the clinical diagnosis follows:

TABLE I

Fifty cases with transfer electrocardiogram interpretation (enlisted)

Transfer electrocardiogram interpretation *confirmed* 39

A. Normal electrocardiograms	18 cases
Acute rheumatic fever	6
Arterial hypertension	3
Arteriosclerosis, generalized	5
Miscellaneous	2
No heart disease found	2
B. Abnormal electrocardiograms	21 cases
Acute rheumatic fever	6
Arterial hypertension	2
Arteriosclerosis, generalized	2
Congenital heart disease	2
Tuberculous pericarditis	2
Coronary sclerosis	3
Cardiac arrhythmia	3
Miscellaneous	1

Transfer electrocardiogram interpretation *not confirmed*11

A. Normal electrocardiograms	4 cases
Rheumatic fever, acute	2
Paroxysmal tachycardia	1
No heart disease	1
B. Abnormal electrocardiograms	7 cases
Valvular heart disease (mitral stenosis, mitral insufficiency)	1
Arterial hypertension	1
Arteriosclerosis	2
Pulmonary embolism	1
Wolff, Parkinson, White	1
Right bundle-branch block, type C—misdiagnosed as left bundle-branch block	1

TABLE II

Fifty cases (officers) in which previous electrocardiogram diagnoses were compared with those at W.R.G.H.

(Diagnoses agree in 35, disagree in 15)

Explanation of erroneous diagnoses:

1. Single Q_3 - T_3 pattern—"myocardial infarction."
2. Previous electrocardiogram normal. Anoxemia test + at W.R.G.H.
3. "Probable myocardial infarction" from T wave changes during digitalis treatment.
4. "Coronary occlusion" based on diphasic T_4 in exhausted man.
5. Transitory diphasic T_1 and T_4 caused diagnosis of "myocardial change." Final diagnosis uncertain.
6. "Coronary artery disease" based on normal tracing.
7. "Myocardial damage" based on flat T_{123} in case of pulmonary embolism and infarction.
8. "Myocardial disease" diagnosed during digitalis treatment. W.R.G.H. diagnosis: Digitalis effect.
9. "Myocardial damage" based on normal electrocardiogram.
10. "Myocardial damage" based on normal electrocardiogram.
11. Bundle-branch block (left) based on electrocardiogram of bundle-branch block (right); final diagnosis based on intrinsic intervals.
12. Posterior and anterior infarction based on electrocardiogram of digitalis effect.
13. Diagnosis of mitral stenosis or myocardial infarction based on normal electrocardiogram.
14. Diagnosis of "myocardial disease" based on low T_1 during tachycardia.
15. Diagnosis of coronary sclerosis and myocardial insufficiency based on normal electrocardiogram.

Summary:

1. Diagnosis of organic heart disease based on insufficient evidence or on normal electrocardiogram: 10.
2. Cases in which refined methods of diagnosis altered the original impression: 2.
 - a. Exercise test produced positive result after a previously normal tracing.
 - b. Diagnosis of left bundle-branch block changed to right bundle-branch block after study of intrinsic intervals of multiple chest leads.
3. Erroneous or hazardous diagnoses of organic heart disease in patients treated with digitalis: 3.
4. Diagnosis of organic heart disease in patient with pulmonary embolism: 1 (also included under 1 above).

Of the 50 officer cases, unselected except that previous electrocardiograms had been made elsewhere, the interpretations recorded by previous observers and by ourselves agreed in 35. In these cases, the interpretations were compatible with the final diagnoses, assuming that angina pectoris can exist in the presence of normal electrocardiograms—routine and following exercise and anoxemia.

In some, the divergence of opinion was not very wide. In case 1, a Q_3 - T_3 pattern was observed on one occasion only, giving rise to a previous diagnosis of myocardial infarction. All other tracings in the series being normal, we thought the evidence insufficient on which to base that diagnosis. In case 2, we found the anoxemia test of Levy useful, as it produced signs of coronary insufficiency, when the routine films were normal. In case 3, a diagnosis of probable myocardial infarction was based on minor T wave changes after digitalis and during quinidine therapy; as the changes could have been due to drugs or to cardiac strain incident to auricular fibrillation, such a diagnosis is fraught with hazard. In case 4, a diagnosis of coronary occlusion was based on transitory diphasic T waves in lead 4 F in an exhausted individual; we felt that the evidence was insufficient. In case 5, a diagnosis had been made of "myocardial change" on the basis of transitory diphasic T_1 and T_4 ; subsequent exercise and anoxemia tests were normal. The possibility of "myocardial change" existed: in such a case, one cannot be dogmatic either in favor of the diagnosis or against it; caution is indicated.

As to case 6, we had to disagree with the earlier diagnosis of coronary artery disease, since review of the series of tracings convinced us that they were all within normal limits.

In case 7, a diagnosis of "myocardial damage" and later "angina pectoris" had been made from flattening of the T waves in the limb leads. Careful study at this hospital revealed signs of previous pulmonary infarction, and review of the history suggested this to be a much more probable diagnosis. On arrival at Walter Reed General Hospital this patient was well and showed a normal tracing.

In case 8, the diagnosis of myocardial disease was made in the presence of digitalis effect: in our opinion, the electrocardiographic changes were due to digitalis.

In case 9, one has the impression that the cardiologist was making a diagnosis based on both mechanical and clinical evidence: in fact, the clinician and the cardiographer in this case were the same person. A review of the reports shows that a diagnosis of "early myocardial damage" was made at a time when the electrocardiogram appears normal, while "myocardial infarction" was thought to have occurred when T_1 became somewhat lowered. The diagnoses may have been correct but they ran far ahead of the evidence.

In several other cases, a diagnosis of organic heart disease was based on tracings that appeared to us to be within normal limits. Case 12 is a beautiful example of the difficulty that may follow neglect to record drug therapy on the request for electrocardiograms. In this case the patient was under the effect of digitalis—a fact not noted on the requests—and the cardiologist was misled into making the diagnosis of "posterior occlusion based on old anterior myocardial infarction." (Figure 1)

COMMENT

This short series of cases has no statistical significance; they represent, however, some of the common difficulties in electrocardiographic diagnosis, and they emphasize the most common mistake in current practice—the deduction that various changes in T waves necessarily represent organic heart disease. In 9 of the 50 cases a diagnosis of organic cardiac disorder was made or suggested on changes in the electrocardiogram that would not meet current conservative criteria. In 3 of the 9 cases, the changes could have been due to digitalis therapy, and, in our opinion, more nearly resembled changes due to this drug than those due to organic heart disease. In one, all the evidence points to pulmonary embolism and infarction, with simple flattening of $T_{1,2,3}$ incident thereto.

The effect of digitalis in causing the S-T intervals in limb leads to slope downward into diphasic T waves, or to sag beneath the iso-electric line, is rather generally known. It might be emphasized, however, that the T waves in C-F₄ may develop a cove-shaped inversion that closely resembles the effect of anterior coronary occlusion. Occasionally, errors may be traced to the fact that an entry reporting digitalis therapy on the electrocardiographic request is dropped on cessation of digitalis therapy. To protect the electrocardiographer and to help in his interpretation, it would be well to enter a note stating whether or not digitalis had been administered within a month of the requested test. In most cases, the digitalis influence vanishes well before a month has elapsed. In some cases, however, the electrocardiographic changes tend to linger, and it is a safe rule to consider the possibility that this drug may be at work for a month after its withdrawal.

The largest number of errors in electrocardiographic interpretation, according to our observation, derives from “reading into” the film a diagnosis of coronary occlusion or “myocardial change,” or some such organic disease, when the T waves show changes of little or no significance, or when a simple inversion of such waves may better be explained from drug therapy, coronary sclerosis, cardiac strain, or strain associated with pulmonary embolism. So many conditions have been observed to lower or to cause inversion of the T waves (including drinking cold water) that it seems strange there is a pronounced tendency to attribute all such changes to organic heart disease. A common cause of confusion is pulmonary embolism.

The differentiation between coronary occlusion and pulmonary embolism may be exceedingly difficult on clinical evidence alone. In a group of cases of pulmonary embolism, the most common error lies in making a diagnosis of coronary occlusion. This may cause bias on the part of the cardiologist, who, observing certain T wave changes, is inclined to concur in the false diagnosis. Criteria for electrocardiographic diagnosis of pulmonary embolism have been reported by Murnaghan, McGinn,

and White¹ and by Sokolow, Katz, and Muscovitz.² Recently, Hampton, Prandoni, and King³ reported ten cases of pulmonary embolism among persons who were at work and in apparently good health. The sudden onset, the violence of the symptoms, the cyanosis and dyspnea, and the consequent fever and increase in sedimentation rate and leukocytes, all offer tempting bait to one who is inclined toward ready diagnosis of coronary occlusion. Yet, it is of the utmost importance to differentiate the two conditions. The electrocardiogram may be very helpful. Among our own cases of pulmonary embolism we have not observed the typical series of S-T changes so characteristic of coronary occlusion. We have observed flattening of the T waves in leads 1 and 2 or in all leads, inversion of T₃, inversion of T₂ and T₃, and early elevation of the S-T segment in leads 2 and 3. The T waves were observed in one case to be flattened in the limb leads and upright in C-F₄. We have observed sudden lengthening in the Q-R-S complex, with subsequent shortening, approaching the original picture.⁴ (See figures 2, 3, and 4.) Shift of the electrical axis to the right, inversion of T waves in C-F₂ and ₃ may occur. In general, it may be said that pulmonary embolism should be suspected in any case in which an acute chest condition roughly suggesting coronary occlusion occurs in the absence of typical electrocardiographic evidence of occlusion — notably, significant deviation of the S-T segments and typical cove-shaped T waves. It must also be remembered that the electrocardiogram is frequently unchanged by a pulmonary embolus.¹

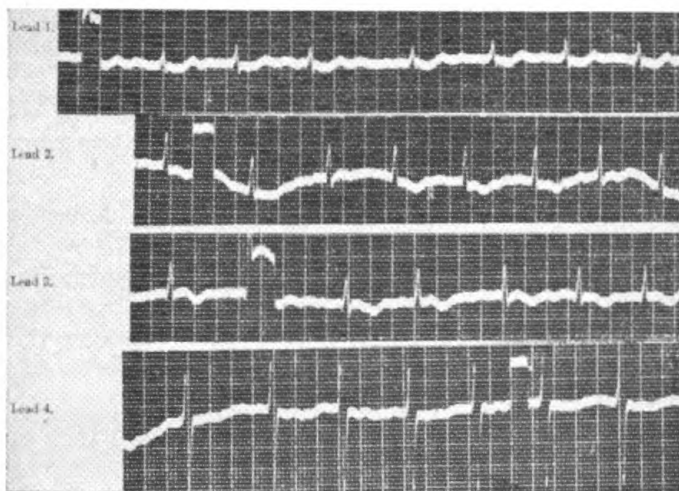


FIGURE 2. Case of massive pulmonary infarction, verified by necropsy, in woman with mitral stenosis, auricular fibrillation. Patient had received digitalis. Tracing before infarction. Note fibrillation, digitalis effect.

The following case shows how the electrocardiographer may overreach his diagnostic potentialities.

1. Murnaghan, D., McGinn, S., and White, P. D.: Pulmonary Embolism with and without Acute Cor Pulmonale, *Am. Heart J.*, 25:573-597, May 1943.

2. Sokolow, M., Katz, L. N., and Muscovitz, A. M.: The Electrocardiogram in Pulmonary Embolism, *Am. Heart J.*, 19:166-184, Feb. 1940.

3. Hampton, A. O., Prandoni, A. G., and King, J. T., *Tr. Ass. Am. Physicians* (in press), 1944.

4. Durant, T. M., Ginsburg, I. W., and Roesler, H.: Transient Bundle Branch Block and Other Electrocardiographic Changes in Pulmonary Embolism, *Am. Heart J.*, 17:423-430, April 1939.

An officer, 53 years of age, in the A.A.F., had primary atypical pneumonia associated with nonspecific urethritis. He was treated with sulfathiazole and had a reaction of idiosyncrasy, with fever. Serial electrocardiograms showed progressive changes in T_1 and T_4 , which slowly became diphasic, then inverted; they then reversed themselves, becoming normally upright through similar changes in the direction of recovery.

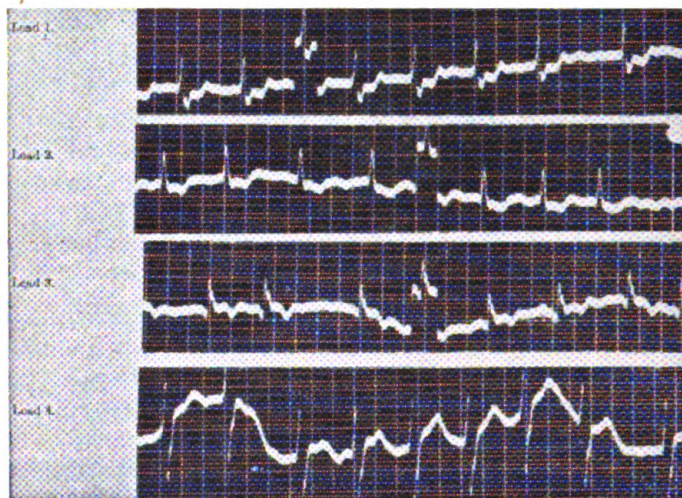


FIGURE 3. Same case four days after pulmonary infarction. Note right bundle-branch block and depressed S- T_1 , giving "staircase" effect in terminal part of complex.

There was some dyspnea during the febrile episode, but no pain; there was no change in the level of the S-T intervals and no cove-shaped T waves. The report was that the changes were "compatible with anterior myocardial infarction." One cannot prove this impression erroneous, but it is at best misleading. Such changes are also compatible with cardiac strain, with the effect of toxins or infections on the myocardium

and with simple coronary insufficiency. Subsequent exercise tests produced no evidence of impaired cardiac function.

In some cases it is the clinician who is too brash.

An officer, aged 50, had "cellulitis" of the left foot in 1942, after which he became subject intermittently to cramps in the calves of the legs. He had a cholecystectomy early in 1943. In both of these years, roentgenograms of the chest showed mottling of the lung bases, the nature of which was not clarified. He had several sharp pains in the region of the right diaphragm on different occasions, and he was admitted to hospital for an attack of such pain in April 1944. For five days preceding this attack he had been somewhat dyspneic and had had some mild retrosternal pain. Except for pallor, examination was normal. Blood pressure, leukocytes, temperature, and repeated electro-

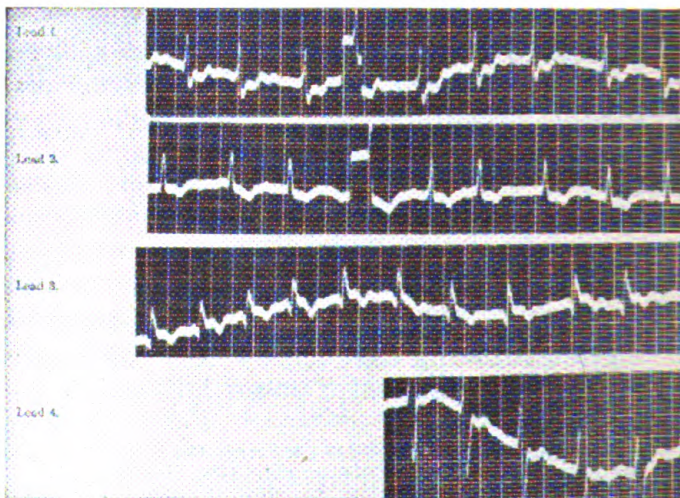


FIGURE 4. Same patient six days after infarction. The bundle-branch block is less marked and the Q-R-S duration is approaching normal. Depression of S- T_1 and negative T_2 and T_3 persist.

consistently normal. Though the electrocardiographer reported all tracings to be normal, the clinical diagnosis, at the time the patient was transferred to Walter Reed General Hospital, was "coronary occlusion." Admission examination at this hospital was normal except for a definitely positive Homans's sign on dorsiflexion of the right foot and a very suggestively positive sign on the left. He is now being studied for signs of venous thrombosis and pulmonary embolism. There was no positive sign of coronary occlusion, and it would seem, in retrospect, that the normal electrocardiograms should have received more weight in the diagnosis.

Coronary occlusion versus pulmonary embolism.

A 33-year-old, white, enlisted man entered a station hospital on 26 December 1943 with measles. On 2 January 1944, when again ambulatory, he had a severe pain in the chest, became dyspneic and cyanotic, and collapsed. Pulse regular, 108. Blood pressure, 105/70. Rales at both lung bases. Reduplicated first tricuspid sound. Diagnosis: Coronary occlusion. The patient was given a full course of digitalis in the first twenty-four hours. On 11 January he developed severe pain in the right upper abdomen, radiating to the right shoulder. Blood-streaked sputum appeared.

On transfer to Walter Reed General Hospital there was dullness at both lung bases. Breath sounds were absent below the right scapula, decreased below the left. No fremitus was felt at either base. Only a few rales at the right base were heard. Roentgenograms showed densities at the left and right lung bases interpreted as being due to pulmonary infarction. On 30 January phlebograms showed obstruction of the deep veins of the right lower extremity.

Review of serial electrocardiograms shows an early inversion of T_2 and T_3 , with a rather low T_1 ; these changes had been interpreted as indicating probable posterior myocardial infarction plus digitalis effect. T_3 became cove-shaped and inverted, T_4 notched. By 19 April the tracing had become entirely normal. (Figures 5 and 6) The diagnoses at Walter Reed General Hospital were: (1) Thrombosis, anterior and posterior tibial, popliteal and femoral veins, right, secondary to phlebotrombosis. (2) Embolism, pulmonary, right and left lower lobes, secondary to No. 1.

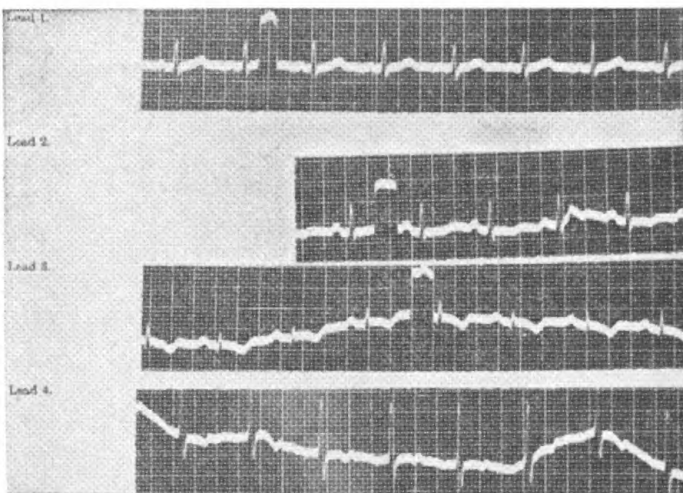


FIGURE 5. Electrocardiogram in case of soldier with pulmonary embolism and infarction, ten days after initial attack, and ten days after receiving 10 cat units of Digalen. Note diphasic T_2 , inverted T_3 , diphasic T_4 . Such changes are found in pulmonary infarction, though some digitalis influence is remote possibility. Transfer diagnosis: Coronary occlusion.

In this case, it is our view that nonspecific changes in certain T waves of the electrocardiogram incident to large pulmonary emboli were considered mistakenly to have been due to coronary occlusion. The cardiologist in this case was influenced

by the clinical picture in his diagnosis of the electrocardiogram. This is a sound principle, but it is well for every clinician to bear in mind that the symptoms of coronary occlusion and of massive pulmonary infarction may be very similar.

SUMMARY

1. As observed from records of patients transferred to a general hospital, the difficulties in electrocardiography may be classed as *technical* and *interpretative*.

2. A minority of films, especially some of those returned from overseas, are "light struck," making subsequent interpretation difficult.

FIGURE 6. Case of same soldier three months later. The tracing is now normal. The patient has recovered.

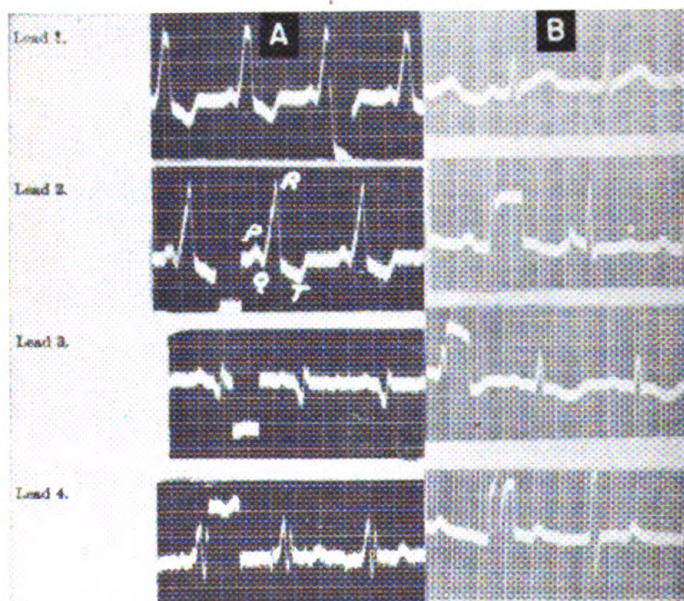
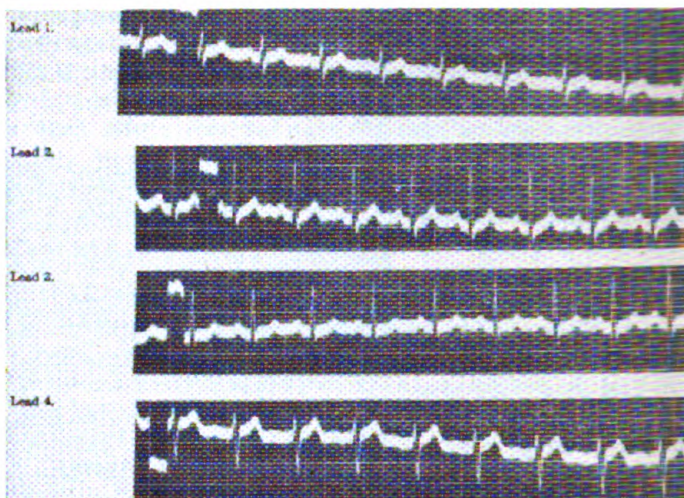


FIGURE 7. Case of Wolff, Parkinson, White syndrome, showing: A, short P-R (auriculoventricular) conduction interval (0.11 sec.) and long Q-R-S (intraventricular) conduction (0.14 sec.). In B the tracing has become normal, following quinidine. Though the W.P.W. syndrome is benign, the transfer diagnosis was "coronary occlusion," based on electrocardiogram and chest pain incident to paroxysmal tachycardia.

Failure by the requesting medical officer to note administration of drugs on the electrocardiographic form may lead the cardiologist into serious error, particularly in cases in which digitalis or quinidine had been exhibited. Normal standardization of the string is recorded in less than one-half the films reaching this hospital. In about one-fourth the cases the film shows over or under standardization. In the remaining cases, almost one-third, no standardization

was recorded. Correct standardization recorded on the film is very helpful to subsequent observers.

3. Most of the observed errors of interpretation are derived from the tendency to suggest a diagnosis of myocardial "infarction" or "change" in the presence of minor or temporary abnormalities of the T waves, or even in the presence of a normal electrocardiogram. Among 100 unselected case in which transfer films were available at this hospital (50 officers and 50 men), the transfer diagnosis could not be confirmed in 26.

4. In another report from this hospital, it is shown that pulmonary embolism is an important condition in the erroneous diagnosis of coronary occlusion or angina pectoris. Cases of S-T change and of sudden prolongation of Q-R-S after pulmonary embolism are shown in figures 2 to 6.

5. The effect of drugs, notably of digitalis, leads to erroneous diagnosis of myocardial infarction.

6. The Wolff, Parkinson, White syndrome (short P-R interval, prolonged Q-R-S and liability to paroxysmal tachycardia) may be mistaken for an instance of myocardial disease. (Figure 7)

7. The electrocardiographic picture of cardiac strain may be very similar to that of late myocardial infarction. Instances are shown in figure 8. In some such cases, coronary disease may be present, but it is important not to conclude that a certain configuration of the T waves necessarily indicates myocardial infarction.

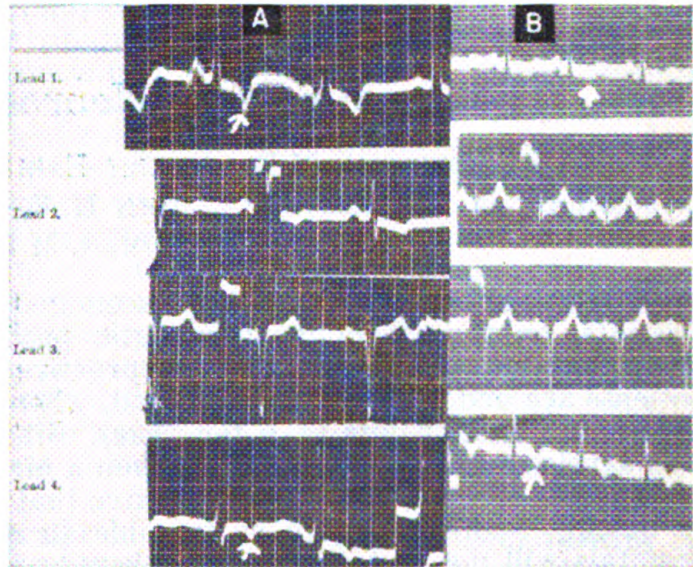


FIGURE 8. Two cases showing effects of cardiac strain. Note predominance of levogram and abnormal T waves in each. A, Female dependent, aged 55. Blood pressure 240/120. No medication. No cardiac symptoms. T_1 and T_4 similar to those found in myocardial infarction. B, Officer, aged 61. Blood pressure 180/100. Mild substernal distress, dyspnea. No medication. T_1 is diphasic, T_4 inverted.

Such cases could be mistaken for myocardial infarction on the electrocardiographic evidence alone; however, depression of S- T_1 is against diagnosis of myocardial infarction.

CONCLUSIONS

1. The electrocardiographic string should be standardized with care and the standardization recorded both in the strip held in the laboratory and in the portion included in the clinical record.

2. The use of digitalis or quinidine, or their derivatives, should be recorded faithfully on the request for an electrocardiogram. In the case of digitalis, it is suggested that administration of this drug within a month prior to electrocardiography be recorded.

3. Care should be taken to recognize the benign Wolff, Parkinson, White syndrome.

4. Electrocardiograms should be read at their face value, objectively and without regard to clinical impressions. It is the responsibility of the attending medical officer, not of the electrocardiographer, to draw final conclusions from the combined clinical and technicological picture.

5. Pulmonary embolism is an important cause of erroneous diagnosis of coronary occlusion or angina pectoris. This condition should be suspected in any acute thoracic episode resembling one of these two conditions in which the course of electrocardiographic changes is not typical of coronary disease.

The Treatment of Neurosyphilis

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PAUL A. O'LEARY, M.D., JOHN H. STOKES, M.D.,
and EVAN W. THOMAS, M.D.

Symptomatic neurosyphilis as seen in the military service presents, on the whole, a therapeutic problem which differs from that encountered in civilian practice. The majority of patients are under 35 years of age and, when detected, will have had their infection less than ten years. Since most servicemen who develop neurosyphilis will be given a medical discharge and returned to civilian life, it is imperative that patients be treated as quickly and thoroughly as possible in order that military hospitals will not be too long encumbered and yet give patients good fundamental therapy.

These facts mean that: (1) the great majority of cases of neurosyphilis observed in the military services will be of the types which appear early in the course of syphilis, i.e., meningeal and meningovascular syphilis; (2) the basis of therapy (for the more resistant and severely involved cases) must be fever; and because it offers the best insurance against relapse, the type of fever will be malaria unless specifically contraindicated.

The limitations imposed by these considerations reduce the therapeutic management of neurosyphilis to relative simplicity. It is therapy on the "mass production" basis, directed and designed for the group.

Neurosyphilis has its beginning sometime within the early period of infection. Although reliable statistics are not avail-

The third and last article in the series on neurosyphilis. The preceding articles were published in the September and October Bulletins, respectively.

able, it is believed that the central nervous system is invaded by the spirochete in the majority of cases. Fortunately, immune factors in the host clear the central nervous system of the invaders shortly after the infection is acquired, in about 60 percent of the cases. There remain an estimated 40 percent which have evidence of persistent central nervous system infection. These cases form a reservoir from which clinical neurosyphilis subsequently develops. Some patients undoubtedly live their normal life expectancy without symptoms and without treatment; and some, after the development of a few signs and symptoms, recover (burn out) without treatment. However, this fortunate outcome cannot be counted on and every asymptomatic case discovered by spinal fluid examination should have treatment, if warranted by reasonably long life expectancy.

During the invasion of the central nervous system all tissues are involved, although ultimately the patient will manifest signs of meningeal, meningovascular, vascular, or parenchymatous disease. Meningeal syphilis usually develops relatively early, i.e., within one to eight years following the initial infection; chronic meningovascular syphilis appears in five to twelve years; whereas, general paresis and tabes dorsalis are not usually manifest until ten to twenty years after the primary infection. During the years before symptoms and signs are evident (asymptomatic neurosyphilis) the character of the cerebrospinal fluid abnormalities may give a clue to the type of disease which may eventually develop. A more trustworthy indicator than the character of the spinal fluid in a single examination, however, is the response or lack of response of the spinal fluid to vigorous chemotherapy. The spinal fluid which remains strongly positive (Group III) after six to eight months of vigorous chemotherapy points to the ultimate development of parenchymatous neurosyphilis.

A comparable variation in the response to chemotherapy is found in the fully developed case of neurosyphilis. Meningeal syphilis responds relatively quickly and satisfactorily to chemotherapy; meningovascular syphilis responds less well; and parenchymatous neurosyphilis (tabes and general paresis) responds little or not at all.

TREATMENT METHODS

1. *Trivalent arsenical compounds* and bismuth preparations are useful in neurosyphilis. Authorities agree that all cases should receive several short courses or one long course of a trivalent arsenical and of bismuth at some time during the period of treatment.

As experience has increased in the last ten years, mapharsen or other phenarsine hydrochlorides have become the trivalent arsenical of choice. They have the advantage of low toxicity and rapid spirocheticidal activity. Because of their rapid rate of excretion, the optimum interval of administration is at least

twice a week. Mapharsen may safely be given as often as every other day for sixteen to thirty doses in cases with active disease and without recent arsenical treatment. Administration in this manner is especially useful in syphilitic meningitis. Because of its antimalarial activity, mapharsen cannot be given during the course of malaria, but it can be used advantageously during the course of artificially induced fever therapy.

The first dose of mapharsen may be 0.03 gm. (as a matter of precaution) with subsequent doses of 0.06 gm. After mapharsen has been administered for some time, it is not uncommon to encounter nausea and vomiting, occasionally intense. This reaction does not indicate sensitization and can be managed by reducing the individual dose and simultaneously increasing the frequency of administration so that the total drug is not reduced.

2. *Tryparsamide* is a pentavalent arsenical compound which has value in the treatment of neurosyphilis. On the other hand, its use is attended by a risk of permanent visual damage.

3. The effect of *penicillin* in neurosyphilis is under investigation and cannot be satisfactorily discussed at this time.

4. *Fever therapy.*

a. *Malaria* is the most prevalently used form of therapeutic fever and, all things considered, gives the most satisfactory results. It is effective in all forms of neurosyphilis, but it is necessary to supplement malaria with chemotherapy, for malaria does not satisfactorily protect the patient against late visceral disease. Benign tertian malaria (*Plasmodium vivax*) is most generally used, but in persons immune to it, quartan malaria (*Plasmodium malariae*) may be employed. Immunity to tertian malaria is usually found among Negroes, Orientals, and people who live in malarious districts. Although estivo-autumnal malaria (*Plasmodium falciparum*) has been used by a few experts in the field of malariology for therapeutic fever, the dangers involved are so great that it must *not* be used.

Therapeutic malaria is produced by the intravenous injection of 2 to 5 cc. of whole blood (with or without citrate) taken from a patient with active fever. It is not necessary to withdraw the blood at any special time in the cycle of fever. With the inoculum kept below 5 cc., it is not necessary to cross-match the blood. Intramuscular and subcutaneous injections are not recommended since the incubation period is prolonged and unsatisfactory fever usually results. In some centers, therapeutic malaria is transmitted by bites of laboratory-bred mosquitoes, the number of bites being carefully controlled. This method requires highly trained personnel and special equipment and is not satisfactory for general use.

Specimens of citrated malarial blood withdrawn under aseptic conditions remain infectious for at least ten to fifteen hours. Modern transportation, therefore, permits almost all sections of the country to obtain specimens from nearby centers of treatment.

Tertian malaria. After an incubation period varying from three to twelve days, the patient develops a gradually increasing fever which is usually continuous in type for two or three days and then enters the period of intermittent paroxysmal fever. During the first week the patient is occasionally greatly debilitated with vomiting, marked anorexia, and some weight loss and requires careful observation. Later, although weight loss continues and anemia develops, there is general improvement and the patient may be up and about the hospital ward except during the rigor and fever. It is customary to take the temperature by rectum every four hours, day and night, until its elevation above 102° , when it is taken every hour. If the temperature should reach 106° , more frequent recordings are indicated in order not to miss the peak. Although in tertian malaria the rectal temperature occasionally reaches an elevation of 107° to 107.6° , no great concern need be held unless the hyperpyrexia comes early in the disease and the patient has had an excessively high and long-continued fever. In that instance the patient should be given sponge baths with tepid water and should be frequently observed by an experienced physician. Weak, thready, irregular pulse at a rate of 150 per minute, with stupor or semi-coma, are indications for immediate termination by the cautious administration of intravenous quinine dihydrochloride (S.G.O. Circular Letter No. 153, 19 August 1943, paragraph 5c). However, as experience and confidence on the part of the attending physician increase, few cases of intravenous termination become necessary. Yet caution is advisable, for it is better to terminate the malaria unnecessarily in a number of cases than it is to lose one patient unnecessarily. The same axiom holds true later in the course of malaria when the patient is becoming progressively weaker yet has not had the prescribed amount of fever. It is better to have a live patient with inadequate fever than a dead patient with adequate fever!

Headache, malaise, and anorexia with nausea and vomiting are common features of induced malaria. Lightning pains of tabes and psychotic symptoms of paresis are frequently exaggerated during the fever but most often can be controlled by analgesics and sedatives. Exhaustion and prostration which result from loss of chlorides through sweating can be avoided by the routine administration of 1 to 6 gm. of sodium chloride daily. Malaria causes a rapidly progressive anemia. Hemoglobin determination should be performed at intervals, but interruption of the fever need not be considered unless the hemoglobin falls below approximately 7.0 gm. percent or the red blood cells below 2.0 million. In approximately one-half of malaria cases, mild jaundice occurs, most likely of hematogenous origin from rapid destruction of red blood cells. Rarely, deep jaundice develops, usually in association with a large, tender liver, and when it occurs it should be viewed with alarm. The spleen is enlarged in the majority of cases and is frequently painful. Rupture of

the spleen followed by death is a remote possibility but occurs in somewhat less than one in a thousand cases. A moderate increase in N.P.N. with albuminuria is frequent and of no special importance. However, renal failure needs always to be considered and especially watched for in elderly patients. Retention of urine is common in tabetic and taboparetic patients and may require catheterization.

The blood pressure falls in every case. It is usual practice routinely to record the blood pressure daily, but it should be taken more often if vascular collapse seems impending. A more reliable sign of the state of the vascular system is the pulse rate, which normally rises to 120-140 during the paroxysms but should fall promptly to 70-90 with defervescence. A persistently elevated pulse rate, 140-160 during fever, 110-130 during afebrile periods, is to be considered a serious sign and calls for termination of the malaria. The diet may be as desired, and every effort should be made to keep the fluid intake at a level of from 3,000 to 4,000 cc. per day.

The soluble bismuth compound, bismuth thioglycollate (thio-bismol) is of great usefulness in the management of tertian malaria. A single intramuscular injection of 0.1 gm. about twelve hours before an expected paroxysm will obliterate the paroxysm and provide the patient a temporary respite. It is especially useful when the fever is running a quotidian (daily) course. Bismuth thioglycollate given at the height of the fever will prevent a paroxysm on the following day and convert the malaria into a true tertian course. An injection of 0.1 gm. on two succeeding days will usually stop the fever for six to eight days. The results of administration of this drug during the early period of continuous fever are less satisfactory, and sometimes a severe paroxysm with very high fever is precipitated. It is also of less value in quartan malaria.

Authorities differ on the amount of fever which constitutes an adequate course of malaria. Some carefully calculate the number of hours of fever above 102° and try to attain a minimum of 130 hours. Others base the calculations on the number of paroxysms of fever reaching 102° and above, and try to attain a total of from eight to twelve paroxysms. Either method is satisfactory provided the time for interruption of the malaria is based on the clinical condition of the patient and not on whether the prescribed amount of fever has been permitted.

Quartan malaria is less satisfactory than tertian because of the long incubation period of about three weeks, the length of time required to obtain an adequate course (paroxysms every third or fourth day), and the poor quality of fever which generally occurs. The results of treatment by quartan malaria are, however, good, and the time factor should not deter its use when needed. In individuals found immune to tertian malaria, quartan is the treatment of choice.

Tertian malaria is routinely terminated by quinine sulfate

0.3 gm. t.i.d. orally for seven to ten days, or by atabrine 0.1 gm. t.i.d. for ten days. Quartan malaria requires additional medication, atabrine 0.1 gm. t.i.d. for five days, followed by quinine 0.3 gm. t.i.d. for ten days.

The contraindications for malaria are: age of 60 years or more, unless exceedingly well preserved; cardiac disease with history of congestive failure; hypertension with evidence of renal involvement; extensive renal disease; active or extensive healed pulmonary tuberculosis; carbuncles, boils (extensive), thrombophlebitis, cellulitis, and other potentially severe suppurative infections; and physical debility and malnutrition.

Malaria carries with it more than ordinary risk in patients with heart disease with aortic regurgitation, convulsions, severe or uncontrolled diabetes, cirrhosis and other diseases of the liver, severe psychotic conditions requiring sedation, and tabetic bladder with urinary retention.

Malaria should be interrupted for: persistent tachycardia (120-140) in afebrile periods; intractable nausea and vomiting; rise in N.P.N. to 70 to 80 mg. per 100 cc.; severe prostration and debility; severe jaundice; vascular collapse with systolic blood pressure below 70 mm. Hg., cyanosis, weak, thready pulse, and clouded consciousness; convulsions not controlled by medication; severe anemia (below 7 gm. percent hemoglobin or below 2 million red blood cells); and detection of infection with *falciparum* parasites.

b. *Artificial fevers.* On the theory that the temperature elevation in malaria is the effective feature of that form of therapy, a number of methods for the artificial induction of fever have been developed. Some years of experience were required before the present reasonably safe methods were evolved. There remains some difference of opinion in regard to the relative worth of artificial fever and malaria but no doubt exists that, in experienced hands, artificial fever is comparatively safe and effective in the treatment of neurosyphilis.

Artificial fever has the advantage of being controlled in elevation and duration. The general physical condition of the patient is improved almost at once. The disadvantages are that the equipment is expensive and specially trained nurses and doctors are required for constant attendance during and for several hours after stopping the treatment.

Artificially induced fever is not without danger. No fool-proof method has been devised. The dangers are burns, heat prostration or heat shock, and death from cardiac or respiratory failure. However, adequately trained, cautious workers are able to recognize signals of danger and are prepared to meet them.

The methods now prevalently used consist of a cabinet arranged to house the trunk and extremities in a thermostatically controlled atmosphere of hot, moist, circulating air. The temperature of the box—circulating air—is held at a specified level during induction and reduced during prolongation. Because

sweating with little or no evaporation is profuse, it is necessary constantly to replace sodium chloride and water. This is managed by having the patient drink a total of 1,500 to 2,500 cc. of 0.4 to 0.6 percent sodium chloride solution at intervals during the treatment. Intravenous saline is often necessary and desirable. Sedation is occasionally needed to allay fear and reduce restlessness. However, sedatives add a complicating factor and it is safer to omit them whenever possible.

In such a cabinet the rectal temperature can be elevated to 106° F. in about one and one-half hours. It is customary with each treatment to prolong the fever at a level of about 105.6° F. for two and one-half to five hours. A temperature of 106.2° F. should never be exceeded. Best results have been obtained by a total of ten to sixteen treatments given twice a week.

This type of fever cannot be used in all persons. Some patients, although cooperative, unafraid, and anxious to receive treatment, are unable to withstand the heat. As the rectal temperature rises they become increasingly restless, agitated, mentally confused, and uncontrollable by safe amounts of sedation. Physical restraint may be dangerous, for it leads to exhaustion and collapse. A large percentage of the colored race comes in this category.

Good results are obtained by artificial fever in all forms of neurosyphilis, but the most satisfactory results are obtained in late meningovascular syphilis and tabes dorsalis. Artificial fever has the advantage over malaria of causing less debility during treatment, but in patients with general paresis, the relapse rate is higher among those treated with artificial fever than among those treated with malaria.

Combined artificial fever and chemotherapy. In the past several years considerable evidence has been obtained by a number of investigators to show that combined artificial fever and chemotherapy produce better results than if either is given separately. Various methods are under experimental study at the moment. Until further clinical observations on this method of therapy are available, it should not be used by the Army.

c. *Typhoid vaccine* intravenously, in graduated doses, may be used for the production of therapeutic fever. The most practical and the safest method is the dilution of stock vaccine in small amounts of normal saline so that 1 cc. of solution is equivalent to about 100 million bacilli. The dosage is then based on the approximate number of suspended bacilli. For the first treatment a dose of 50 to 75 million is used; second treatment, 100 to 150 million; and with each subsequent treatment the dose is increased by 100 to 200 million organisms. The temperature response is facilitated by the application of hot-water bottles and blankets. If a second injection, one-third to one-half the dose of the first, is given as the fever rises following the original chill, the height and duration of the fever is increased. The injections must be intravenous, not subcutaneous.

In patients who have had typhoid fever or recent immunization against typhoid this method is frequently unsatisfactory, but in the majority good fevers may be obtained. Frequently, after the first and second treatments, many patients have a prolonged temperature rise associated with considerable general malaise, muscle pains, anorexia, and vomiting. Subsequent treatments, however, are better tolerated. A course of fever by typhoid vaccine consists of sixteen to twenty paroxysms with rectal temperatures above 103° F. The results of this type of fever therapy are inferior to malaria and artificial fever. As a method of fever for neurosyphilis, it is distinctly third best and should not be employed if other methods are available.

Occasionally, intravenous typhoid vaccine in single doses is employed to stimulate or provoke fever in patients inoculated with malaria after malarial paroxysms have ceased naturally. It is not recommended in tertian malaria during the incubation period. In patients inoculated with quartan malaria, typhoid vaccine may be used with safety during the long incubation period to reduce hospital time. The combination, however, has no special therapeutic advantage.

TREATMENT OF SPECIAL FORMS OF NEUROSYPHILIS

The following section is in accord with War Department Technical Bulletin TB MED 48, 31 May 1944, "Management of Neurosyphilis." The outlines of treatment recommended are, in part, to provide for reasonable standardization under military conditions and for "the maximum benefit of treatment which can be secured by hospitalization in a general hospital not to exceed three months." They are in general accord with current civilian practice, though in some instances, adequate treatment cannot be given within a three-month period, requiring its continuance subsequently in civilian life.

1. *Early asymptomatic neurosyphilis (less than two years' duration of infection) with minimal to moderate (Groups I and II) spinal fluid changes.* In general, such cases will be detected only after chemotherapy, whether given by the standard six-month system recommended in paragraph 4b(2)(e), S.G.O. Circular Letter No. 74, dated 25 July 1942, by more intensive methods of arsenical chemotherapy, or by penicillin, since in early syphilis, generally, diagnostic lumbar puncture is not performed until the completion of such treatment.

These cases may continue treatment on an ambulatory basis. Arsenical and bismuth chemotherapy should be repeated for an additional six-month trial period, by the standard six-month system referred to above. Mapharsen, 0.06 gm., may, however, be given three times weekly, rather than (as in uncomplicated cases) twice weekly, thirty injections to the course, sixty injections in all. At the end of this period of chemotherapy, the spinal fluid should be promptly re-examined. If the spinal fluid has not shown improvement toward or to complete normality, the patient

should then be transferred to a designated general hospital for fever therapy.

2. *Early asymptomatic neurosyphilis with maximal (Group III) spinal fluid changes.* Regardless of the time at which discovered, such cases should at once be transferred to a general hospital for fever therapy.

3. *Late (more than two years' duration of infection) asymptomatic neurosyphilis with Group I spinal fluid changes.* Whether detected before any or after previous chemotherapy, give standard chemotherapy for six months as in paragraph 1 above. If no improvement in the spinal fluid, transfer for fever therapy.

4. *Late asymptomatic neurosyphilis with Group II or III spinal fluid changes.* Regardless of when discovered, transfer for fever therapy.

5. *Asymptomatic neurosyphilis, duration of infection unknown, with Groups I and II fluids.* Chemotherapy for six months, as in paragraphs 1 and 3 above. If no improvement, transfer for fever therapy.

6. *Asymptomatic neurosyphilis, duration of infection unknown, with Group III spinal fluid changes.* Fever therapy.

7. *Acute syphilitic meningitis.* Such cases should be treated with chemotherapy for six months, as in paragraph 1 above; but here it is essential rather than optional that mapharsen should be given three times weekly to a total of sixty injections in six months (two courses of thirty injections each). Symptoms will disappear immediately in the majority of cases, and the spinal fluid cell count and protein content will be reduced to normal, with varying degrees of improvement in other spinal fluid tests. At the end of this six-month course, treatment may be discontinued if the patient is symptom free and the spinal fluid entirely normal.

A second period of six months of similar chemotherapy should be given if the patient is symptom free and the spinal fluid cell count and protein content are normal, but if the spinal fluid Wassermann and colloidal curve, though improved over the original examination, still show some evidence of positivity.

Fever therapy should be given at the end of the first six months of chemotherapy if (a) symptoms persist or (b) the spinal fluid is still strongly positive, relatively unimproved. Also, fever therapy should be given after the second six months of chemotherapy if any abnormality persists in the spinal fluid.

8. *Diffuse meningovascular and vascular neurosyphilis.* These cases should be handled in the same manner as acute syphilitic meningitis (paragraph 7), except that in certain older patients with focal vascular accidents (especially if complicated by cardiovascular syphilis), the intensity of mapharsen therapy should be reduced. The utmost diagnostic care must be exercised in these cases to exclude general paresis.

9. *All other forms of neurosyphilis, especially general*

paresis, tabes dorsalis, and all cases of primary optic atrophy. Fever therapy is immediately obligatory.

To recapitulate, chemotherapy approximately as outlined should be used in: early asymptomatic neurosyphilis, with Groups I and II fluids; late asymptomatic neurosyphilis, with Group I fluids; asymptomatic neurosyphilis, duration of infection unknown, with Groups I and II fluids; acute syphilitic meningitis; and diffuse meningovascular and vascular neurosyphilis.

Fever therapy should be used in: all cases in the categories above which do not respond satisfactorily to chemotherapy within six months; early asymptomatic neurosyphilis with Group III fluids; late asymptomatic neurosyphilis with Groups II and III fluids; general paresis; tabes dorsalis; and primary optic atrophy.

Chemotherapy following fever therapy. In most cases, as soon as malaria is terminated and during convalescence from this infection, mapharsen, 0.06 gm., should be given daily for ten doses, to a total of 600 mg. Subsequent chemotherapy need not be employed unless necessitated by clinical progression or relapse or by the recurrence of spinal fluid abnormalities, especially pleocytosis and increased protein content.

RESULTS TO BE EXPECTED FROM TREATMENT

Asymptomatic neurosyphilis, early or late. Excellent in terms of prevention of development of clinical forms of neurosyphilis. Especially in patients with Group III fluids, some degree of positivity of the complement-fixation reaction may persist for many years, even after fever therapy. Other spinal fluid abnormalities should disappear.

Acute syphilitic meningitis. Clinically excellent, though some cranial nerve lesions (extraocular muscle palsies, deafness) may persist. In adequately treated cases, the spinal fluid usually becomes normal, though in some with Group III fluids, changes may persist in the complement-fixation test.

Diffuse meningovascular and vascular neurosyphilis: Variable, depending on the type of lesion. In general, most patients do surprisingly well, both from clinical and laboratory standpoints. The spinal fluid, after showing moderate improvement, may remain positive for a long time. Rising cell count and protein content are forerunners of relapse.

In assessing the remission of clinical symptoms in diffuse meningovascular neurosyphilis, the physician must keep in mind neurological residuals which are prone to result from vascular occlusions, cortical scar formations, etc. The development of epileptic seizures or the persistence of painful paresthesias does not necessarily indicate advancement or persistence of the inflammatory process.

General paresis. In the armed forces, each patient presenting the minimum requirements for the diagnosis should be treated as general paresis. From the standpoint of its serious

potentialities, both in regard to life expectancy and to residual permanent nerve tissue damage, general paresis constitutes a real medical emergency. Years of experience have clearly demonstrated that *fever* is the form of therapy which can be relied on to arrest the progress of general paresis in the largest percentage of cases. As expected, the ultimate success of therapy is directly related to the duration of symptoms prior to the institution of adequate treatment. The disease appears to be arrested, with return to excellent functional condition, in about one-third of patients treated; varying degrees of incomplete remission arrest with some degree of residual defect in about 60 percent; in about 10 percent all forms of treatment are unavailing and death is inevitable.

Following the termination of fever therapy, clinical improvement usually occurs, reaching its maximum at about six months. Some cases respond very promptly; in a few, clinical improvement may be delayed a year or more. Improvement in spinal fluid cell count and reduction in protein content usually occur within a few months. Other abnormalities, especially a positive complement-fixation test, may persist for many years. In spite of maintenance of a satisfactory clinical status, or at least no evidence of advance of the disease process, the spinal fluid should be examined regularly at six-month intervals. The cell count and total protein are the first tests to reach normal levels and are the most sensitive indicators of activity of the syphilitic process. Persistent elevation, or the return to abnormal levels, of either or both of these tests usually precedes the development of a clinical relapse, and indicates the possible need of a second course of fever treatment. The spinal fluid complement-fixation reaction and colloidal gold test are less sensitive and, if they remain abnormal, do not necessarily indicate impending relapse. A complement-fixation test which remains strongly positive or reverts to positive in 0.1 cc. of fluid eighteen months to two years after treatment is to be considered an indication of persistent activity, regardless of the other tests, and may foreshadow an ultimate relapse. A second course of fever may be given to a patient with such a fluid examination.

Tabes dorsalis. In general, cases in which symptoms develop within the first ten years of the disease, or in which symptoms come on acutely, are associated with the strongest spinal fluid reactions and, paradoxically, are often the cases which obtain the greatest benefit from treatment. Conversely, patients with a long history of visceral crises, lightning pains, and slowly developing ataxia show the least active spinal fluids and obtain disappointingly little benefit from antisiphilitic treatment.

Optic atrophy. The results of fever therapy depend on the degree of damage before treatment is instituted. In general, in patients in whom visual acuity in the better eye is 20/40 or better, there is about an even chance of arrest of the atrophic process and the maintenance of useful vision.

Secondary Suture of War Wounds

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The necessity for adequate débridement without suture is a principle definitely established for the primary management of war wounds in forward areas.¹ The factors which make this form of therapy necessary include the extensive damage to tissue, the interval often present between the time the injury was received and the time surgery may be available, and the frequently extensive contamination of war wounds.

During a period of rapid evacuation of war casualties, it is often necessary for a number of different surgeons to care for an individual within a relatively short time. This fact alone would make primary closure dangerous, except in special cases of wounds of the head, face, or chest.

The almost universal use of débridement without suture results in a large number of war wounds that require a long time to heal, unless measures are taken to hasten this process. It is important to secure early complete healing of wounds in order that the soldier be returned to duty as soon as possible. Successful secondary closure also means a better cosmetic result, more rapid general improvement, and the avoidance of the possibility of protracted ulceration in a large cicatrix.

WOUNDS SUITABLE FOR SECONDARY CLOSURE

The wounds most suitable for this procedure are those involving soft tissues, which have been adequately débrided within the past ten days, have not been subjected to frequent changes of dressing, and appear, clinically, to be relatively clean. Wounds older than ten days, showing slight secondary infection in patients who are fever free, may often be prepared for closure by using warm, wet dressings for a short period.

Studies are now being undertaken in specially designated installations to determine whether or not a number of successful secondary closures may be accomplished in cases with compound fractures. It is also believed that, with careful use and good judgment, penicillin may extend the use of secondary closure to other cases in which it is not considered desirable at present.

1. Delayed Closure of War Wounds, Bull. U. S. Army M. Dept., 73:1-2, February 1944.

FACTORS FAVORING SUCCESSFUL SECONDARY CLOSURE

These factors are essentially the same as those of importance in the healing of any wound by first intention. Of greatest importance is the lack of significant infection in the wound. Closure without tension, adequate hemostasis, the avoidance of dead space, and suitable postoperative splinting are the most important local factors favoring successful secondary closure. In the general systemic management of such cases the maintenance of a normal red blood cell count, hemoglobin, and plasma protein level is important.^{2 3} Vitamin C deficiency should be guarded against, since many patients under combat conditions for a period of time may not have had adequate vitamin intake.^{4 5 6 7} Sulfonamides have been used systemically and locally in some cases; however, successful closures are possible in many instances without the use of sulfonamides.

ANALYSIS OF CASES

A study was made of 138 secondary closures performed on 105 patients. The time from débridement to the time of secondary closure varied from four to forty-seven days. The size of the wound varied from a few centimeters to one measuring 30 by 8 by 4 centimeters. The time of closure was based principally on the gross appearance of the wound. In 79 closures, cultures were made prior to operation; however, if the wound appeared grossly clean, operation was usually carried out without further delay. In 73 of the cases cultured, bacteria were found. In almost every instance the organism grown was the *Staphylococcus*. No streptococci were cultured from these wounds.

Method of closure. Various procedures were used in effecting closure, in some instances the wound being approximated loosely with sutures, while in other cases a complete excision of the wound was performed, followed by closure in layers. Drains were used, as a rule, only in very deep wounds involving muscle beneath the deep fascia. In all cases the wounds were splinted postoperatively with a pressure dressing and in numerous instances casts were used for immobilization in case the wound was near a joint.

Results of closures. The best results were obtained in cases closed within ten days of the primary débridement. In these cases the wound was usually found to be clean following the

2. Thompson, W. D., Ravdin, I. S., and Frank, I. L.: The Effect of Hypoproteinemia on Wound Disruption, Arch. Surg., 36:500-508, March 1938.

3. Thompson, W. D., Ravdin, I. S., Rhoads, J. E., and Frank, I. L.: Use of Lymphile Plasma in Correction of Hypoproteinemia and Prevention of Wound Disruption, Arch. Surg., 36:509-518, March 1938.

4. Hojer, J. A.: Studies in Scurvy, Acta paediat., Upps., 3:8-278, Supp., 1924.

5. Lanman, Thomas H., and Ingalls, T. H.: Vitamin C Deficiency and Wound Healing, Ann. Surg., 105:616-625, April 1937.

6. Aschoff, L., and Koch, W.: Skorbut; eine pathologisch-anatomische Studie, 122 pp. Jena: Gustav Fischer, 1919.

7. Lind, James: A Treatise on Scurvy, 3d ed., 559 pp. London: S. Crowder, 1772.

initial débridement, and no preparation with wet dressings was found necessary.

Among 57 closures performed within ten days of the time of débridement, 44 (77 percent) healed by first intention, 7 (12 percent) were listed as showing 75 percent, or better, healing, and 6 cases (11 percent) were listed as failures. The entire group of 138 closures showed primary healing in 86 cases (62 percent), while 41 cases (30 percent) of this group were listed as showing healing with slight infection, and 11 closures (8 percent) of the entire group were listed as failures.

In the closures done after the ten-day interval, complete wound excision was done in 44; 65 percent of these healed absolutely by first intention, 4 percent showed complete failure, while the remainder showed slight infection of the closed wound; however, the procedure was definitely worth while.

In 37 closures beyond the ten-day interval, accomplished by simply bringing the edges of the wound loosely together after mobilizing the edges of the wound, only 38 percent healed without evidence of wound infection, 8 percent were listed as total failures, and the remainder showed slight infection. However, the infection was of no serious consequence, and healing occurred far more rapidly than would have taken place otherwise. In the 49 closures with positive cultures preoperatively, 67 percent healed without evidence of infection, while 13 percent showed total failure. In the 5 closures in which "no growth" was reported by the laboratory, 4 cases showed no evidence of infection, while the remaining case showed only slight infection.

The positive cultures usually showed a *Staphylococcus* present, in several instances the organism being a hemolytic *Staphylococcus*. It is believed that organisms were present in all cases and that only a quantitative difference existed.

DISCUSSION

A series of 138 closures is too small to be of great significance statistically. It appears clear, however, that wounds which have had a thorough débridement and appear grossly to be clean in patients who are free of fever should be closed before ten days have elapsed if the best results are to be obtained in the highest percentage of cases. It should be emphasized that such wounds, if dressed at all before the actual time of closure, should be handled with great care, lest contamination from the respiratory tract cause secondary infection. It was our practice in such wounds to inspect them simply and briefly, using mask technique. If wounds appeared clean, they were scheduled for closure immediately. In such instances, the wound edges were usually mobilized easily and closure without tension was accomplished readily.

In cases received after ten days, it was usually necessary to institute wet dressings, for a period varying from two to seven days, before the wound appeared suitable for secondary closure. In our early experience these wounds were managed by two methods. In some instances, the wound edges and the granulating base were all excised and the wound was closed tightly. In other cases, the edges were simply undermined slightly, and the wound was sutured loosely over the granulating bed. This method was employed in the belief that it did less to disturb natural local barriers which had been thrown up to control infection. After using both methods, it is our impression that better results in old cases are obtained, as a rule, when wound excision is performed. The explanation may be that in such cases there is likely to be less dead space than in instances when the floor of the wound is made up of granulation tissue. Healing without evidence of infection is the desired result, but if slight infection does result, necessitating the removal of one or two sutures for drainage, the patient usually still benefits greatly by the procedure. No complications of any consequence occurred in this series of closures.

SECONDARY CLOSURE AND SKIN GRAFT

In some cases where there has been extensive tissue loss, complete closure without tension may prove impossible. In such cases, complete closure was usually best accomplished by covering the remainder of the wound with a split skin graft at the time of partial closure. Careful dressing of the wound at the time of operation and proper immobilization, using plaster in cases near joints, proved very valuable, as would be expected. Mason has called attention to the value of correct splinting of healing wounds to prevent breaking up the collagen bridge.⁸

While this discussion has dealt largely with local factors in wound healing, one should not minimize the importance of such systemic factors as a normal state of hydration, normal red cell count, hemoglobin and plasma protein level, and an adequate store of vitamin C in the tissues.

CONCLUSIONS

1. Successful secondary closure of adequately débrided war wounds can be accomplished safely in a high percentage of cases.
2. Closure within a ten-day interval results in a higher percentage of wounds which heal by first intention.
3. In old wounds the best results were obtained by wound excision.
4. The importance of both local and general factors in wound healing is emphasized.

8. Mason, Michael F.: Wound Healing, Illinois M. J., 78:523-529, Dec. 1940.

Orientation Data Regarding Psychoneurosis

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Without early consideration and correction, mild personality disorders in soldiers tend to become fixed. However, premature and unnecessary hospitalization is a disaster. Recovery is resisted unless assurance can be given that the soldier will not be returned to the same untenable situations that caused the symptoms. Differences in points of view both in line officers and in medical officers lead to conflicting interpretations of personality disorders in soldiers, and these in themselves tend to fix the symptoms further. Punitive instead of helpful attitudes in line and medical officers and frequent negative examinations combined with indecision tend to fix personality symptoms. Psychoneurotic disorders constitute most of the personality problems that are encountered during the early training period. A psychoneurotic reaction in reality is an attempt by the person to effect an adjustment that will obviate tension and prevent the occurrence of anxiety. Such psychoneurotic reactions as anxiety states, hysterical reactions, and obsessive states are therefore exaggerations of normal personality functions. An individual may be inefficient and suffer some conflict on account of one or a combination of the following factors: his endowment or constitutional make-up, disturbing relationships to others, poor training, or unpleasant experiences. Lack of success, dissatisfaction, fear, discontent, overdependence on others, and conflict all require solution. An emotional autonomic readjusting reaction accompanies these difficulties; that is, tension is mobilized to meet the situation. Thus, tension is a prerequisite for activity and must be relieved by action, preferably accomplishment with satisfaction and gratification. If this does not occur, the personality is endangered through inability to act. If the control functions or their modifiers are such as to prohibit action, emotion forces the issue and breaks out as anxiety. In all soldiers showing excessive tension and anxiety, the problem may be solved in one of several ways:

1. The personality may heed and utilize the "alarm" through an anxiety attack, with subsequent but transient release of tension. The individual then accepts and understands his needs and difficulties and remmarshals his abilities for a new trial. Here line and medical officers can be of greatest aid in preventing psychoneuroses in soldiers through a discussion of the situations responsible for the anxiety. The constructive use of awareness of anxiety in all its forms, and the prevention of further anxiety are the methods by which health is ordinarily maintained.

2. The second method by which we meet anxiety is by enduring it and attempting to perfect resistance, which may be only partially successful. When a chronic unrelieved emotional tension state exists, soldiers may develop symptoms referable to various organs or systems of the body, especially the gastro-intestinal, cardiovascular, respiratory, and nervous systems.

3. Soldiers may try to resolve existing tension and anxiety by attempting to protect themselves through psychological evasions such as the development of hysterical types of disorder with the characteristic sensory-motor and mental phenomena, the development of hypochondriasis, or the development of obsessive states. Early understanding and treatment by both line and medical officers will salvage many in this group.

CLASSIFICATION

Psychoneurotic reactions are classified as follows:

1. *Anxiety states* which always follow a period of strain and tension. The early symptoms and signs are fatigues of a capricious nature, feeling of uneasiness and tension, restless desire for activity, irritability, poor concentration, jumpiness at sounds, battle or occupational dreams. The characteristics are fear, both focalized on an object or "free-floating," nightmares, preoccupation with fear of injury and making mistakes, decline in judgment as to directions, fear of failure to conceal anxiety. The disorder may then go on to: (a) acute anxiety, with periodic attacks of palpitation and chest pain, breathlessness, weakness, cold sweat, dizziness, fainting; (b) acute anxiety state plus terror; (c) stupor. Any or all of these may cause mental confusion and loss of memory for the period. These need not always be classed as psychoneuroses, if no impelling force is apparent. Examples of nonneurotic disorders are the "combat reactions," training fatigue, reactive tension states, "operational fatigue," "psychological failure," all of which are transient and easily relieved by constructive discussion and removal from stress. Then the man can return to duty with good prognosis. Whatever neurosis is present may be disregarded for that episode. The line officer who knows his men and meets his responsibilities for their well-being will prevent their occurrence. He will also institute remedial steps which will in most cases make unnecessary the aid of a medical officer. These steps will consist of: group identification; identification with leader; proper assignment commensurate with soldier's ability; stimulation of genuine interest in training programs; proper graduation of hardening program; prevention of boredom and nostalgia by encouraging good fellowship through sports, competitive games, prizes, recreation; promotion of self-confidence and pride in himself, his outfit, and his equipment; thorough acquaintance with the methods and objectives of his organization; belief in the necessity for fighting this war and in the goals and purposes of the war; and group discussion and free debate regarding war aims, peace settlement, and relations to civilian population during time of war in order to prevent confusion and discouragement. Poorly informed soldiers may believe they are unfortunate victims while

civilians fatten on war profits. Full use should be made of the material furnished by O. W. I. and War Department publications on current events.

2. *Hysterical reactions*, which may simulate nearly any ailment through an emotionally produced disturbance in, or loss of, body or mental functioning. The physical signs and symptoms do not follow anatomic patterns and often seem fraudulent. Often there are no early symptoms and signs, although the following prodromal symptoms may be found: fatigue (usually less severe than for anxiety states), resentment and grumbling, some tension, hypersensitivity and irritability, talk of being incapacitated by physical sickness, accidents, or wounds. Frequent hysterical patterns are: paresis or paralysis of muscle groups or extremities, muscle tics and tremors, jerking which in some may simulate convulsions, gait disorders, blindness, deafness, rigidity states and stupor, automatic movements, wandering with or without loss of memory (amnesia). The states previously known as "gas neurosis" or "shell shock" were often of this type. Prognosis for recovery from the attack is often good.

3. *Hypochondriasis*, which is characterized by constant complaining of body difficulties and belief that some disease exists or some part of the body is at fault without there being an adequate objective basis for the complaints; inclination to use sickness and complaints as excuses for inactivity, frequent visits to sick call, and a tendency to feel inadequately treated or mistreated. Prognosis for full duty is poor; these reactions very often conceal prepsychotic states.

4. *Obsessive-compulsive states*: (a) Obsessive states are characterized by the soldier's expressing morbid and insistent doubts, showing too much attention to superstitions, fear of dirt, disease, arms or ammunition, and of killing. (b) Compulsive states, practically identical with obsessive states, are characterized by peculiar repetitious acts, head-turning, checking and rechecking work and orders, compelling rituals of thought and action, and therefore slowness and inefficiency. In each instance tension develops and if he cannot comply with his urges and thoughts he becomes more tense, confused, and inefficient. Obsessional syndromes occasionally conceal prepsychotic states and may be associated with panic states and severe depressions.

5. *Psychosomatic disorders*. Recent literature has emphasized the so-called psychosomatic reactions; unfortunately, some confusion, which Alexander¹ has helped clarify, has crept into the understanding of the proper classification according to pathogenesis. Visceral symptoms may be divided into three groups.

(a) A human being may become irritable, anxious, frightened, tense, discouraged if exposed to sudden, overwhelming situations. A man frightened because of an accident or threat to his life will probably show increased heart rate, difficult breathing, sweating, tremors, diarrhea, and

1. Alexander, F.: Fundamental Concepts of Psychosomatic Research; Psychogenesis, Conversion, Specificity, Psychosom. Med., 5:205-210, July 1943; correction, 5:400, Oct. 1943.

incoordination, with some disturbances in thinking. These are not necessarily dependent on any underlying neurosis.

(b) The second group of body symptoms also often verges on the borderline. These are the classical hysterical reactions: paralysis, anesthesia, hysterical choking, hysterical blindness and deafness. These symptoms have a definite meaning in relation to recent and remote disturbing events. The prognosis is excellent for the attack but they usually recur.

(c) Another large group of somatic symptoms must be differentiated from the foregoing groups, because they are caused by chronic, persistent internal conflict which only secondarily causes physical changes in an organ, such as peptic ulcer, neurodermatitis, irritable colon and bowel distress, mucous colitis, hypertension, and some cases of bronchial asthma. These chronic internal conflicts have been found on prolonged examination to be due to psychoneurosis.

DIFFERENTIAL DIAGNOSIS

A psychoneurosis is not to be confused with a psychosis, in which the reality testing ability, as determined by insight and judgment, has been found to be grossly impaired according to legal and medical standards. Medical standards are more liberal since they do not depend on archaic assumptions. Excellent work performance or superb endowment is not to be considered as evidence of the absence of a psychoneurotic reaction type, since many successful men suffer from various neurotic disabilities which are not always apparent to superficial inspection.

During recent years it has become increasingly fashionable for physicians to ascribe disorders of unknown origin to psychoneurosis. In some circles of the armed services there is an increased tendency to minimize known organic and physical defects as a cause for complaints. The highest degree of medical and surgical skill is required to give good judgments in this field. Soldiers with flat feet are sometimes compelled to march because the medical officer is unwilling to believe that this condition can cause symptoms. Old head injuries, backaches following apparently minor injuries, pains after operations, obscure vascular disorders, joint pains, brucellosis, parasitic infestations, tuberculosis, avitaminosis, and certain endocrinopathies are conditions occasionally called psychoneurosis because the underlying condition is not diagnosed. Persons with a psychoneurosis may have an independent organic disease. The diagnosis of a psychoneurosis can only be made on positive findings such as infantilism and immaturity, regression and fixation, irrational fears, exaggerated behavior, exaggerated mood changes, obsessions, rituals, overestimation of self, disturbances in work capacity, use of time, money, food, clothes, useless repetitive behavior, senseless hostility, competitive envy, and aggression with fear of retaliation. A physician may unwittingly suggest and fix symptoms for these patients by his attitude toward them, unnecessary and repeated negative examinations, ineffectual symptomatic therapy, and misplaced oversolicitude.

A number of diseases of the central nervous system, easily overlooked in their incipient stages, may cause disturbances in behavior which may be mistaken for psychoneurosis. These in-

clude head injuries, brain tumors, multiple sclerosis, the convulsive states, and central nervous system lues. There are many individuals suffering an epilepsy or epileptic character who do not have convulsions. Much care should be given to the diagnosis of borderline mental deficiencies, since these individuals may show personality disintegration under stress, which resembles the psychoneuroses. Even mental defectives may have a true psychoneurosis, but symptom formation as a defense to overwork is a common reaction in mental defectives.

Skill is necessary to differentiate the psychoneuroses from the prepsychotic forms of hypomania, manic-depressive states, and, most of all, from early manifestations of schizophrenia which have the superficial appearance of a hypochondriacal reaction, depressive reaction, obsessive reaction, or criminalism with or without sex perversion. To do justice to some of these severely ill people who are making a strenuous effort to maintain the appearance of normality requires discrimination as to whether or not they should be called psychoneuroses.

The most difficult diagnostic problem is to make the distinction between psychoneuroses and the constitutional psychopathic states. The psychopath may also have many neurotic symptoms of the types described and due to the same causes; namely, internal conflicts. However, his principal difficulty lies symptomatically in the field of human relationships. The psychopath's behavior is characterized by poor conscience values and inability to observe a conventional code of conduct, irrationality, "stereotyped repetitivism, self-destructiveness" often shown in criminalism, sexual misdemeanors, explosive emotional outbursts, chronic alcoholism, inability to conform to training schedules, frequent A.W.O.L.'s, and constant craving for change and excitement, in spite of the fact that he knows he will be caught and punished, if indeed he does not arrange the latter.

True malingering is rare in the Army. On examination, a host of conflicting conscious and unconscious motives are discovered beneath the seemingly apparent conscious dissimulation or exaggeration. The unfortunate equivalent, "gold brick," is used as a punitive term, which indicates a lack of understanding of human beings. Psychoneuroses usually develop in early adult life; that is they first come to clinical notice at this time on the basis of life experiences. There is therefore a certain preparedness for these reactions that can be shown to have existed previously and is relit by the urgencies of the military situation.

It is absolutely essential that greater care be used for more careful discrimination in the diagnosis of psychoneurosis and that W.D., A.G.O. Form 40 (Certificate of Disability for Discharge) state clearly the reasons for such a diagnosis. The write-ups are often incomplete and stereotyped. Many cases appear to be those of general inaptitude and conform to AR 615-360, Section VIII. Some have obvious physical conditions or have been subjected to the following:

1. Poor morale in field units with resulting lack of motivation and persistence in meeting and accepting military responsibilities.
2. Three or more sick calls for the same complaint without evaluation of their personality.
3. Premature and often unnecessary hospital admission.
4. Further fixation of symptoms and resentment in the soldier through repeated negative examinations without consideration of personality factors and attempts at treatment.
5. Further neglect of the human being by coercive and punitive methods such as return to duty, "gold brick" labeling, the attitude that the soldier is cheating when nothing organic is found on physical examination.

After several failures based on faulty assignment and inadequate efforts for understanding, utilization of preventive methods, and adequate treatment in the field as well as in the dispensary and the hospitals, the soldier is often considered a general nuisance and emphasis is placed on getting rid of him instead of trying to understand and restore him to military service. The result is unnecessary loss of manpower and training days, because the soldier loses his sense of duty through the disintegrating effects of his conflicts, making necessary an inferior solution in recourse to body symptoms.

The essential general points for an acceptable diagnosis of psychoneurosis should include:

1. The presence of developmental patterns which indicate the presence of an active neurotic process such as identification with parental illnesses and complaints, persistent fears, night terrors, sleepwalking, food fads, frequent tantrums, rituals, psychogenic enuresis, marked passivity and introvertedness, kleptomania, compulsive masturbation, chronic rebelliousness, repeated gastro-intestinal symptoms, hypersensitivity with impulsive outbreaks, weeping, irritability, prolonged antagonism to parent or sibling, passive dependence patterns, unreasonable aggressive competitive patterns, sadistic or masochistic patterns. The earliest beginnings of these symptoms should always be described, together with the situations which may have precipitated them.
2. Military experiences acting on such a personality make-up and relighting earlier established patterns of reaction (aches and pains, gastro-intestinal responses, panics, rituals, tension phenomena such as headaches, trembling, incoordination, depression).
3. Substitutive activity through which the soldier avoids facing difficult situations, in addition to the well-known "flight into socially acceptable illness," may also include venting resentments originally directed against superiors, or the service in general, against substitutes like inferiors or civilians; alcoholic debauches with fighting to hide feelings of inferiority and for release of tension; bravado and studied carelessness to exposure and danger thus incurring accidents and injuries; association with socially undesirable people, including gamblers, for relief of tension.

To conserve manpower, the line officer must make every effort to utilize men through training, indoctrination, and appropriate assignment. Most men with known personality disorders can be used if they are not separated too quickly by Section II or Section VIII discharges. Good morale is the best prevention of active psychoneurosis and is the obligation of the line officer. Medical officers must help line officers retain any soldier who can render some useful service.

Plasmochin Intoxication

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Plasmochin was first synthesized by Schuleman, Schonhofer, and Wingler, in 1924, by alteration of the structure of methylene blue, to which Ehrlich had ascribed antimalarial properties as early as 1891. In spite of its original derivation, plasmochin is chemically closely related to quinine, having the formula N-diethylamino-isopentyl-8-amino-6-methoxy-quinoline.

Soon after its original synthesization, plasmochin was found to be a powerful antimalarial, surpassed in efficacy only by quinine. Plasmochin is to be compared to quinine, however, only in regard to gametocidal actions. In infections of canaries by *Proteosoma praecox*, this drug even excelled quinine as a therapeutic agent. Its parasiticidal properties during the asexual cycle of infections with *Plasmodium vivax*, *Plasmodium falciparum*, *Plasmodium malariae*, and *Plasmodium ovale* were variable, and, in most instances, weak. On the other hand, its gametocytocidal powers, particularly in falciparum infections, were unsurpassed. It is today the most reliable drug in combating gametocytemia in estivo-autumnal infections.

Because of its extremely toxic effect on gametocytes, this drug was believed capable of eradicating *Plasmodium falciparum* infections by eliminating the sources from which mosquitoes become infected. It was given a fairly widespread trial but was found to be toxic to man as well as to the parasite, and its wholesale use was discontinued as a result of the untoward reactions developing in its wake. It was soon decided that the uncontrolled administration of this drug was highly dangerous, and that supervision by a physician was essential during its administration.

The toxic effects of plasmochin on man cannot be over-emphasized. During the early days of its use, when dosage was irregular, deleterious effects were numerous and severe.

Accepted for publication, 18 October 1943.

As early as 1928, Fischer and Weise¹ concluded that the maximum dosage of this drug should be 0.03 gram daily. Dunn,² working with plasmochin in Ceylon, believed that 0.02 gram daily was a maximum safe dosage and that in combination with atabrine as little as one-half grain of plasmochin daily for five days might be highly toxic to man. This observation has been corroborated by other observers, whose experiences prove that the co-administration of atabrine accentuates the toxic effects of plasmochin. Sollman,³ who also reported this phenomenon, stated there is apparently no similar relation between co-administration of quinine derivatives and plasmochin on the toxic effects of the latter drug. He suggested that the blood of gametocyte carriers is rendered noninfectious for mosquitoes by a single dose of 0.05 gram of plasmochin. Strong⁴ recommends 0.01 gram three times daily on one day, repeated five days later, as being adequate to render such blood innocuous.

REACTIONS

Untoward reactions resulting from plasmochin administration, observed in vivo and in vitro, fall into several groups. Hans Molitor⁵ describes an immediate and a delayed symptom complex occurring in test animals. The former appears shortly after administration of the drug, and is characterized by acute onset, neurocirculatory changes and neurorespiratory changes, while the latter appears after a few days' lapse, following administration of the drug, and presents methemoglobinemia, cyanosis, and eventual respiratory failure. He further states that methemoglobinemia is the most pronounced toxic effect of plasmochin intoxication and that it is seen in man after administration of 0.08 to 0.10 mg. daily. In addition, he stresses the neurocirculatory effects, lowered blood pressure, and vasodilatation, frequently followed by cardiac collapse.

Foy and Kondi⁶ emphasize that the methemoglobinemia of plasmochin intoxication is intracorpuseular, and that it is to be differentiated from the pseudomethemoglobinemia of blackwater fever. Most writers on the subject believe that this

1. Fischer, O., and Weise, W.: Action and By-Effects of Plasmochin in Treatment of Malaria. *Deut. med. Wschr.*, 53:1380-1382, August 1927.

2. Dunn, C. L.: Some Observations on the Therapeutics of Malaria in Ceylon. *Tr. R. Soc. Trop. M. Hyg., Lond.*, 30:233-244, July 1936.

3. Sollman, Torald: *Manual of Pharmacology*, 6th Ed., 608-609. Philadelphia: W. B. Saunders Co., 1942.

4. Strong, R. P.: *Diagnosis, Prevention and Treatment of Tropical Diseases*, 6th Ed., 1:105-106. Philadelphia: The Blakison Company, 1942.

5. Molitor, Hans: *Antimalarials Other Than Quinine, Human Malaria*, 261-263. Lancaster: Science Press Printing Co., 1941.

6. Foy, Henry, and Kondi, A.: A Note on Intracorpuseular Methemoglobinemia. *Ann. Trop. M. Parasit., Liverp.*, 32:249-252, 1938.

methemoglobinemia is not associated with a marked decrease in erythrocyte count.

Stauss⁷ believes that the majority of the severe reactions observed early in the use of plasmochin were due to overdosage. This has been our experience here, and the experience of one of us in Ethiopia in 1930, in both of which studies, smaller, controlled dosage resulted in fewer reactions and in intoxications of less severity. It was also the opinion of Stauss that ambulatory patients suffered untoward reactions less frequently than did bed patients. Our experience here and in Ethiopia has confirmed that observation, but it is to be borne in mind that patients who received plasmochin in the hospital were those having experienced very severe infections, and who were thus more prone to untoward reactions to any type of medication, and that the ambulatory patients were those showing no ill effects from their malarial infection on discharge. This might also have been a factor in the observation reported by Stauss. Further, according to the same author, albuminuria during plasmochin therapy is no evidence of permanent or severe renal damage.

Intravascular hemolysis, jaundice, and other signs and symptoms usually associated with blackwater fever are not commonly reported as being present in plasmochin intoxications. However, Cordes,⁸ in a series of 72 cases routinely treated with plasmochin, reported 4 intoxications of this type, with one death. It is more important to note that in his series, Cordes administered 0.08 gm. of plasmochin daily with 1 gm. of quinine.

Eiselberger,⁹ in 1927, reported a case in which a nonmalarial patient who had recently had six operations for pemphigus conjunctivae, received 0.20 gram of plasmochin over a period of four days. This patient developed jaundice, anemia, fever, and enlargement and tenderness of the liver and spleen. Lichenstein and de Langen, according to Strong,⁴ report eleven deaths probably attributable to plasmochin intoxication, but no details relative to the symptom complex are stated in Strong's reference.

7. Strauss, Herman: Clinical By-Effects in the Use of Plasmoquine and Atabrin, *Arch. f. Schiffs und Tropen Hyg.*, 43:19-43, 55-73, 1939.

8. Cordes, Wilhelm: Incidents in Plasmoquine Treatment, *Arch. f. Schiffs und Tropen Hyg.*, 32:143-148, March 1938.

9. Eiselberger, Karle: Plasmoquine Poisoning, *Trop. Dis. Bull.*, Lond., Sept. 1927.

Our observations in a series of cases which we believe fall in the category of plasmochin intoxications are reported in this paper.

REPORT

The population sample with which our series deals consists of adult males between the ages of 18 and 35, who had been examined and found physically fit within a maximum period of two years prior to receiving plasmochin. Without exception, they had been inoculated against yellow fever within a maximum period of two years. Their medication, diet, work, and rest were regimented. The area in which this series was observed is tropical, and estivo-autumnal malaria is hyper-endemic, accounting for 99 percent of all malarial admissions to this hospital. Yellow fever is rare, and jaundice infrequent. The series on which this paper is based consisted of 846 cases of malaria caused by *Plasmodium falciparum*. All patients were hospitalized.

Our routine laboratory procedure consisted of an admitting thick smear and initial blood cytology, followed by four additional thick smears at four-hour intervals, or until found positive. On report of the fifth consecutive negative smear, a 5 cc. concentration smear was made, and therapy was instituted on the report of a positive smear or on persistence of clinical signs and symptoms of malaria after all six smears had been reported negative.

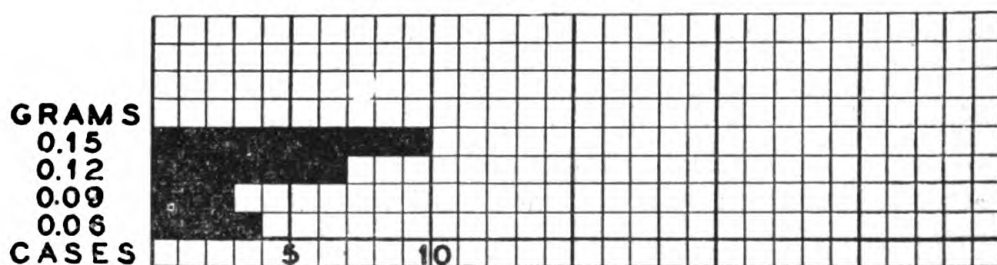
TREATMENT

Therapy consisted of 10 grains of quinine sulfate three times daily after meals for three days, or until the temperature was controlled, followed by atabrine, 1½ grains, three times daily, after meals for five days. Complete blood cytology was obtained on each patient at the completion of eight days of therapy, and no patient was discharged from the hospital until three consecutive negative smears had been reported, and the erythrocyte count was above four million. The average red cell count on the 846 patients at discharge was 4,720,000. After a rest period of two days, each patient was placed on plasmochin, 0.01 gm., three times daily after meals for five days. The entire routine was varied, of course, according to idiosyncracies and reactions of the individual patient. All plasmochin was administered under the direct supervision of a physician, and all patients except one (No. 22) were ambulatory during their period of plasmochin therapy.

Of the 846 cases of malarial fever admitted to this hospital during the period covered by our study, all received plasmochin, and 24 were readmitted to the hospital suffering from complaints which we believe to have resulted from plasmochin intoxication. Of these 24 patients, 2 (Nos. 10 and 18) had experienced four previous attacks of malarial fever each. Plasmochin had been administered to these two patients after each previous attack without any untoward reactions. The remaining 22 patients had not previously been infected with malaria.

The sign-symptom complex presented by this group of patients was not duplicated by any patients not having received plasmochin. Thus, the incidence of intoxication among the 846 plasmochin patients was 2.85 percent. Out of one thousand controls with no history of recent plasmochin administration, four reported to the hospital during the period of our study with jaundice of undetermined etiology. This was an incidence of 0.4 percent, which compared with 2.85 percent in the series under study (or 2.6 percent having hyperbilirubinemia), was well outside the coefficient of chance. In none of these 4 cases was anemia observed.

GRAPH 1
Plasmochin, toxic dose

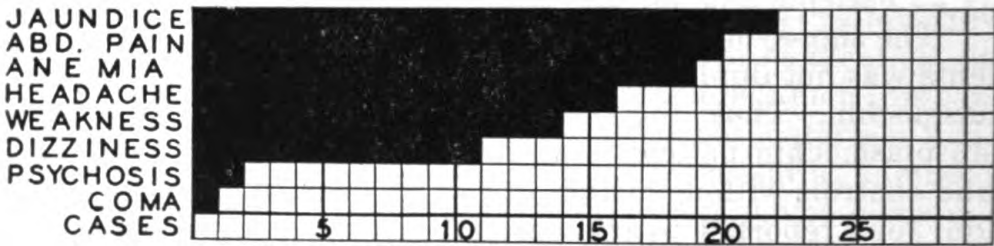


Graph 1 shows the amount of plasmochin received by each patient prior to hospitalization for intoxication. It will be observed that the mode (0.15 gm.) was also the maximum received by any patient. This, of course, is due to the fact that our routine course of plasmochin therapy consisted of 0.15 gm. It is probable that intoxication existed in some of these patients prior to completion of plasmochin therapy, but that symptoms were not severe enough to make the patient seek hospitalization. The smallest amount of plasmochin producing toxic manifestations was 0.06 gm., and four patients were hospitalized after having received this amount of the drug. The mean toxic dose was 0.119 gm.

SYMPTOMS

Graph 2 shows the frequency of the more common individual symptoms and signs in our series of 24 cases. Generally speaking, this complex consisted of jaundice, abdominal pains, headache, nausea, and vomiting. We also observed hyperex-

GRAPH 2
Symptomatology



citability, both subjective and objective, dizziness, stiffness and pains in joints, low back pains, and eructations of gas. Coma occurred in one case, and psychoses were present in 2 of the 24 patients. There were no deaths.

Jaundice, the most common feature in our series, occurred clinically in 20 of the 24 cases, and was hyperbilirubinemia found by laboratory examination in two additional cases presenting no clinical evidence of this phenomenon.

Abdominal pain was found in 19 cases on admission, and occurred in one additional patient subsequent to admission. The pain was usually colicky, recurrent and distressing, subject to aggravation by heavy meals. It was frequently the presenting complaint, but was not confined to any anatomical area, although the most common site (7 cases) was the umbilical region. These pains responded favorably to antispasmodics but, in the absence of medication, were usually the last symptom to disappear. In 5 cases, the abdominal discomfort was present for more than four weeks after the drug was discontinued. In one case (No. 20) the pain was typical of appendicitis, both in locality and nature, and was accompanied by the almost pathognomonic chain of nausea, vomiting, and leukocytosis. Differential diagnosis was made on the basis of presence of jaundice and history of recent plasmochin administration. In another case (No. 2) the abdominal pain appeared following the first dose of plasmochin, and reappeared after each successive administration of the drug.

Nineteen cases presented red cell counts below 4,000,000 on admission. No report of admitting erythrocyte count is available on one patient (No. 7). This case, however, presented an increase in bilirubin. Headache was a complaint of 16 of the 24 patients and was most frequently occipital. It was dull in character and was persistent but responded favorably to acetylsalicylic acid. Fourteen patients complained of weakness which was usually found to be associated with secondary anemia, but two complained of this symptom prior to clinical or laboratory evidence of anemia. Dizziness occurred in 11 patients during plasmochin therapy, but disappeared after the withdrawal of the drug and confinement to bed. It was neither a prominent nor a distressing symptom. Two patients (Nos. 10 and 22) developed toxic psychoses, but in neither case were the manifestations severe. In case 22, the psychosis persisted for two weeks, accompanied by temporary pseudo-blindness and pseudo-deafness, with moderate hallucinations. One patient (No. 15) entered the hospital in a semicomatose state. This patient had recently been hospitalized for cerebral malarial fever, and his convalescence had been stormy.

The temperature among our patients was above normal in 11 of the 24, ranging from 98° F. to 102° F., with a mode of 98.6° F., and a mean of 99° F. A commensurate tachycardia was observed in all but one case, in which exception there was a relative bradycardia. The temperature usually fell to normal within forty-eight hours of withdrawal of the drug, even in the absence of antipyretics. Physical examination was unproductive except for an icteric tinge to sclerae and skin, and occasional muscular rigidity over the site of the abdominal pain. The liver was neither enlarged nor tender, and no splenic abnormality was elicited. Methemoglobinemia, commonly reported in other series, was conspicuously absent among our patients. In only one case was there even a suggestion of methemoglobinemia, and laboratory examination for intracorpuseular methemoglobin did not support this suspicion.

Chart 1 presents the laboratory findings in each patient. It is to be noted that laboratory examinations are incomplete in some cases, and the writers point out that in four instances the total bilirubin determination was made two to three days after the red cell count, thus producing a potential discrepancy. It is notable, too, that in occasional cases, the total bilirubin is disproportionate to the diminution of erythrocytes.

The anemia on admission was variable in degree, and was frequently associated with a moderate leukocytosis. Erythrocyte counts ranged between 1,400,000 and 5,230,000, with a mode of 2,000,000 to 3,000,000 and a mean of 2,880,000. Leukocyte counts varied between 4,500 and 20,800, with a mode of 8,000 to 9,000, and a mean of 10,220 per cu. mm. The differential white count was not distorted. Hemoglobin estimates were determined by the Tallqvist chart, and are not reported here because of the lack of confidence of the writers in the reliability of this method of determination.

The blood picture in these cases was one of hemolytic anemia, with moderate anisocytosis, poikilocytosis, polychromatophilia, occasional nucleated red cell, and consistent increase in reticulocytes. The platelet count was variable to such an extent as to be of no clinical significance.

A tabulation of the parasitic invasion per cu. mm. of blood among our patients during their last malarial attack prior to plasmochin intoxication shows a variation between 180 and 14,000 rings per cu. mm. of blood, with a mean of 4,028. Patient No. 23, with 14,000 parasites per cu. mm. of blood during his last malarial fever hospitalization, suffered a loss of approximately 1,500,000 erythrocytes between discharge from the hospital and re-admission for plasmochin intoxication. On the other hand, patient No. 21, with 195 parasites per cu. mm. of blood, suffered a loss of over 4,000,000 red cells during a similar period.

Nine patients presented some urinary deviations from the normal. The most frequent changes were albuminuria and biliuria, which occurred in six cases each. These two deviations, while found in the same number of patients, were not always concomitant, having co-existed in only two urine specimens. Benzidine tests showed the presence of blood in four specimens. Two of these four specimens were microscopically suggestive of blackwater fever, and casts were found in one of them (No. 22). Of six specimens tested for urobilinogen, three were positive in dilutions above 1-10, and these three specimens showed no abnormality other than increased urobilinogen.

There was laboratory evidence of jaundice by either hyperbilirubinemia, increased icteric index, or both, in all of the 22 bloods examined chemically. The icteric index ranged from 10 to 80, with a mode of 24 and a mean of 27.6. Blood sugar

changes were not remarkable except in one case, which presented 140 mg. per 100 cc. of blood. This patient's blood sugar was repeatedly normal on subsequent examinations.

CONTROL GROUPS

In addition to the group cited under "sign-symptom" complex (*vide supra*), control groups in our study consisted of four types. The first embraced two patients developing a recurrence of clinical and laboratory malarial fever during their hospitalization for plasmochin intoxication (cases No. 6 and No. 9), and four patients showing gametocytes on survey. The former two cases

received routine antimalarial therapy, including routine plasmochin in the hospital, experiencing no ill effects. The four gametocyte carriers reported to us on survey were hospitalized and received plasmochin according to routine dosage. Three of these four patients had no untoward reactions, and all laboratory reports at the termination of their plasmochin therapy were within normal limits. The

fourth patient in this group showed no clinical or laboratory pathology until the fifth day of plasmochin therapy, at which time, he developed signs and symptoms of blackwater fever. Manifestations consisted of dark brown urine, albuminuria, biliuria, glycosuria, and heavy amounts of blood in the urine. Trophozoites of *Chilomastix mesnili* were also present in the urine. The red cell count, which had been 4,000,000 on the fourth day of therapy, fell to 2,700,000 the morning of the fifth day, and to

GRAPH 3

Erythrocyte-parasite relationship by patient

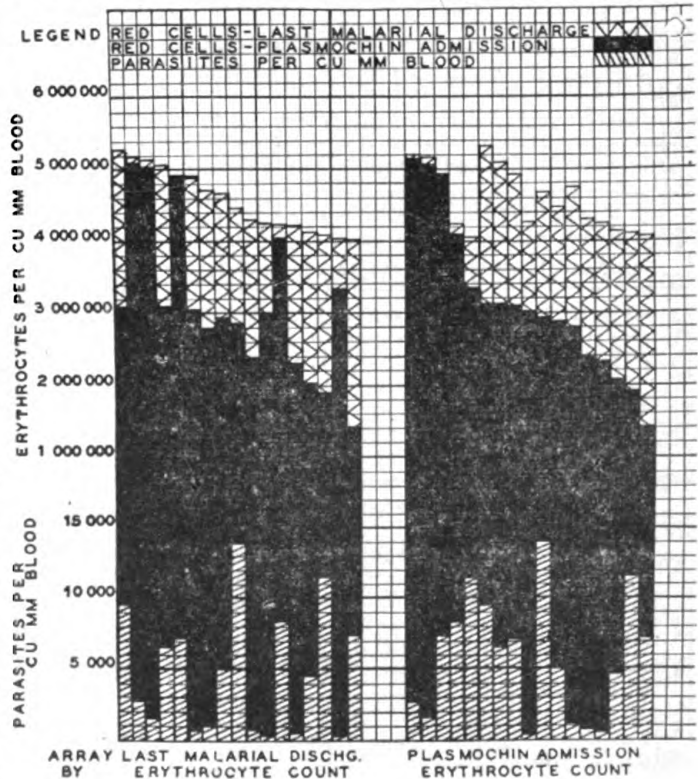


CHART 1
Tabulation of laboratory reports by cases

CASE NO. & NAME	ERYTHROCYTES/CMM		PARASITES PER CUMM.	LEUKO- CYTE COUNT	RETICULO- CYTES	PLATELET COUNT	URINE				N.P.N.	BILI- RUBIN	ICTERIC INDEX	SUGAR	PREVIOUS MALARIA	DAYS IN HOSPITAL	TOXIC DOSE
	LAST MALARIA ADMISSION	PLASMO- CHIN ADMISSION					ALB.	BILE	MACROBI	MICROBI							
1 CM	N. D.	2 000 000	520	13 300	10.1	900000	+	+	-	+	N.D.	4MG.	40	N.D.	0	29	0.15
2 JG	N. D.	2 650000	3 900	14 500	N.D.	N. D.	-	-	-	-	N.D.	2	24	N.D.	0	18	0.09
3 HS	4 720 000	2 900 000	1 026	12 250	3.6	960000	+	+	-	-	27MG	2.4	24	99	0	20	0.12
4 J.E.	4 690 000	3 200000	12 375	10 200	6.1	N. D.	-	+	-	-	N.D.	2MG.	20	N.D.	0	26	0.45
5 J.T.	5 210 000	5130 000	2 942	4 500	N.D.	N. D.	-	-	-	-	38	0.9	12	71	0	26	0.12
6 CW	4 840 000	3 100 000	1 970	10 750	2.1	650000	-	-	-	-	50	2.4	32	N.D.	0	12	0.06
7 RH	5 000 000	N. D.	5 400	7 200	N.D.	N. D.	-	-	-	-	38	2.3	24	105	0	15	0.12
8 J.S.	4 250 000	2 350 000	480	8 550	3.3	420000	-	-	-	-	37	2.1	22	N.D.	0	14	0.12
9 A.S.	4 200 000	3 100 000	2 674	9 650	6.5	550000	-	-	-	-	30	1	19	99	0	20	0.15
10 T.S.	N. D.	5 230 000	625	6 850	N.D.	N. D.	-	-	-	-	N.D.	N.D.	N.D.	N.D.	4	8	0.06
11 G.S.	4 680 000	2 970 000	5 096	7 900	3	520 000	+	-	+	+	28	1.8	19	N.D.	0	22	0.09
12 E.H.	5 170 000	5 020 000	1 620	8 600	N.D.	N. D.	+	-	-	-	N.D.	N.D.	N.D.	N.D.	0	7	0.12
13 EC	4 308 000	3 000 000	180	12 250	2.5	600 000	-	+	-	-	33	3.4	34	93	0	28	0.15
14 J.W.	4 280 000	4 100 000	8 215	7 150	1.2	750 000	-	+	-	-	30	1	19	99	0	16	0.15
15 H.T.	4 150 000	2 010 000	4 400	20 800	8.7	650000	-	+	-	+	N.D.	4.4	60	N.D.	0	72	0.12
16 J.W.	4 740 000	3 030 000	740	5 050	2.6	363 000	-	-	-	-	43	0.4	10	140	0	19	0.12
17 S.L.	4 880 000	4 970 000	7 080	5 750	N.D.	N. D.	-	-	-	-	32	0.4	15	N.D.	0	26	0.06
18 G.H.	4 340 000	2 400 000	915	8 650	2.2	500000	-	-	-	-	41	2.1	27	93	4	18	0.09
19 W.G.	4 100 000	1 900 000	8 050	11 600	11.1	316 000	-	-	-	-	37	0.2	12	91	0	19	0.15
20 G.G.	4 010 000	1 420 000	N. D.	12 050	10.1	350000	-	-	-	-	48	4.8	63	N.D.	0	50	0.15
21 R.R.	5 300 000	1 230 000	195	16 100	3.4	440000	-	-	-	-	37	2.2	243	58	0	59	0.15
22 A.A.	4 420 000	1 400 000	4 070	16 500	6	510 000	+	-	+	+	40	4	80	110	0	72	0.15
23 J.W.	4 470 000	2 880 000	14 000	14 000	3.6	510000	-	-	-	-	N.D.	0.3	12.3	N.D.	0	30	0.15
24 L.W.	4 040 000	3 370 000	180	6 880	N.D.	N. D.	+	-	-	-	N.D.	2.8	33	N.D.	0	24	0.06

2,230,000 the afternoon of the fifth day. The reticulocyte count rose to 3.8 percent on the fifth day of plasmochin therapy. Total bilirubin was 0.4 mg., and jaundice was barely perceptible. The urine, however, cleared up twenty-four hours after the administration of the drug was stopped, and was negative for bile, showing only faint traces of blood, albumin, and sugar, twenty-four hours after the appearance of the first signs

of intoxication. At this examination, however, urobilinogen was present in a dilution of 1-60. Other blood and urine chemistry was within normal limits. Three days later, the urine was negative except for occasional white cells, and at this time, the erythrocyte count had risen to above 3,000,000. During this brief period, the only symptoms this patient complained of were dizziness, generalized headache, and a "biting" sensation in the umbilical region after eating. His previous history showed two prior attacks of malaria, the most recent of which had occurred three weeks before his admission for gametocytemia. During his most recent admission for malarial fever, he had shown a count of *Plasmodium falciparum* of 4,900 per cu. mm. of blood, and a red cell count of 5,000,000 on admission and 4,410,000 on discharge. After the first of his three attacks he had received a routine course of plasmochin therapy with no ill effects. This patient was not included in our series as his intoxication occurred subsequent to the termination of the period covered by this report. It is important to observe that this patient, an apparently healthy adult male, under careful control, completely hospitalized, with access to no other drugs or harmful agents, developed the same signs and symptoms found in other patients under plasmochin therapy with lesser control. This was also true of one of our patients (case No. 22) who received his course of plasmochin in the hospital.

The second control group consisted of 13 postplasmochin patients in whom no symptoms of intoxication had occurred. Blood cytology in this control group showed a red cell count between 2,540,000 and 5,340,000 with a mode of 3,000,000, and a mean of 3,700,000. In 3 of the 13 cases there was an increase in urobilinogen, and one patient complained of mild headaches when questioned directly. Ten of the patients in this group had erythrocyte counts below 4,000,000.

The third control group included 50 nonmalarial patients admitted to this hospital during the period of our study, and having had the same amount of tropical service as patients included in the series. Examination revealed that the erythrocyte counts in the patients of this group fell between 3,400,000, and 5,600,000, with a mode of 4,000,000, and a mean of 4,200,000. Only 2 of these cases had red cell counts below 4,000,000.

The fourth control group embraced 8 gametocyte carriers picked up on survey and 3 patients developing gametocytes during their period of hospitalization for antimalarial therapy.

These patients received 0.01 gram of plasmochin twice daily after meals for two days. In no instance did toxic manifestations develop, and in each case malarial thick smears were consistently negative for gametocytes after the second day of plasmochin therapy.

Chemical and pharmacological examinations of the two plasmochin lots in use at this hospital were essentially negative for contaminants. Captain W. C. Tobie, reporting on these examinations at the Army Medical School, stated that the two lot samples forwarded to him by us appeared identical with other known samples of plasmochin and that there was no evidence of impurity. He suggested the possibility of co-administration of other drugs as a potential factor in producing plasmochin intoxication. All of our 24 patients were questioned carefully on this point, and only one admitted having taken any other medication during the period of plasmochin therapy. This patient stated that he had taken "asthma tablets" during that period, and a check at the dispensary revealed that the tablets had not been given there. It is assumed that the tablets were a proprietary preparation, and their nature and content are not known to us.

Therapy in our series was entirely supportive and expectant. All patients were hospitalized. Forced fluids, including reconstituted plasma and isotonic salt solution with 5 percent glucose, were administered to the more severe cases by venoclysis, and alkalization was a routine measure. All patients recovered uneventfully except one (No. 15), whose reaction was sufficiently severe to require additional study which is being conducted at another hospital.

With the exception of the last-mentioned patient, the average period of hospitalization was 25 days, with a mode of 20 days, a minimum of 7 days (No. 12), and a maximum of 72 days (No. 22).

DISCUSSION

The complete absence of mortality in this series appears attributable to three factors. First, the lower dosage of the drug; second, the early detection of intoxication, with immediate withdrawal of the drug and simultaneous hospitalization; and third, the fact that this series occurred in a prejudiced population sample. It is well within the realm of possibility that without any one of the factors in this favorable triad, some degree of mortality might have been observed.

The incidence of plasmochin intoxication in our series was only half of that reported in the Cordes study, and the same triad mentioned above undoubtedly plays an important part here.

Previous history of yellow fever inoculations in all of our patients suggests the possibility of such inoculations having had some influence on the incidence of plasmochin intoxication. It is our hope, therefore, that a similar study will be reported among a group of patients not previously immunized against yellow fever, bearing in mind of course, the fact that intravascular hemolysis, present in plasmochin intoxications in our series, is not associated with the reactions met in yellow fever vaccinations.

While the majority of observers of plasmochin intoxication have reported intracorpuseular methemoglobinemia unaccompanied by marked anemia, our experience has been just the reverse. Of the eight cases submitted to tests for intracorpuseular methemoglobinemia, none was positive. It is to be noted in this connection, that due to distance of travel of the specimens, three were too badly decomposed to be reported accurately.

CONCLUSIONS

1. Plasmochin is potentially a highly toxic drug when administered in large doses. It does not lend itself well to mass administration even under medical control.

2. Plasmochin, even in the absence of clinical signs or symptoms, may produce varying degrees of secondary anemia.

3. There is no relationship between the number of previous attacks of malaria, the parasitic index, and the incidence of plasmochin intoxication.

4. The individual reaction to plasmochin is inconstant and unpredictable. The drug may be nontoxic to a patient on one administration, and toxic on the next, or vice versa.

5. The untoward results of plasmochin are not permanent, but convalescence is protracted.

6. The dosage of 0.01 gram of plasmochin twice daily for two days is sufficient in most instances to render the blood of a malarial patient noninfectious for mosquitoes, and is simultaneously a safe dosage from the standpoint of potential toxicity.

The Anterior Acrylic Dowel Crown

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The successful use of methyl methacrylate in operative dentistry and crown and bridge prosthesis has given us a practical method of constructing an acrylic Davis crown, more accurately known as the acrylic dowel crown. The steps in the construction of this crown are as follows:

1. Preparation. The preparation should be similar to a jacket preparation where possible and should have a shoulder. As much of the dentin as is useful should be left around the opening of the root canal. This type of preparation will give better support to the crown and ensure accurate centering and seating of the crown during cementation (figure 1).

2. Selection of the shade. An acrylic shade guide should be used to obtain an accurate reproduction of the shade desired. There are sufficient variables encountered normally without having to consider the reflecting qualities of two different materials, porcelain and acrylic resin.

3. Selecting the dowel. The dowel can be of the conventional type but the screw type has been found to be the most practical (figure 1). If, for instance, the crown has to be re-

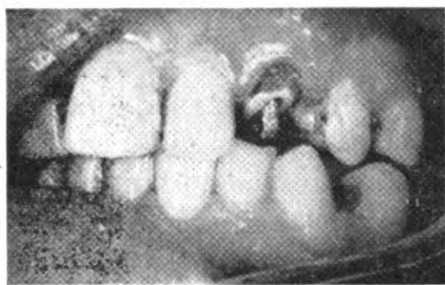


FIGURE 1. Shows preparation of left maxillary cuspid with dowel in place ready for direct waxing.

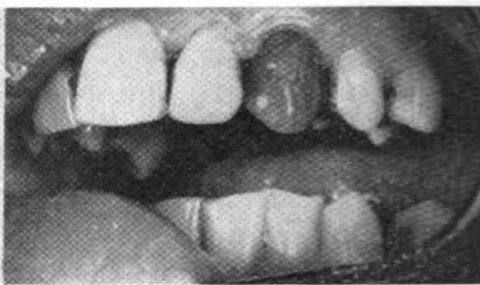


FIGURE 2. Shows pink base-plate wax pattern carved to restore the labial curve of the arch.

moved for any reason after cementation, the acrylic material can be broken away from the incisal part of the dowel and the dowel removed from the tooth by unscrewing it from the cement. If the dowel has grooves cut around it, it is sometimes very difficult to remove without danger of fracturing the root.

4. Carving the wax pattern. The carving of the wax pattern is best done by the direct method. The dowel is placed in the root canal and a roll of softened pink base-plate wax forced over the dowel and preparation and burnished over the

shoulder and under the free margin of the gum tissue (figure 2). The carving of the pattern is completed as in the case of a jacket crown. When the pattern is removed from the tooth, the dowel will come away with the pattern.

5. The pattern and dowel are then invested in a flask with the labial surface up so that proper shading can be done during the packing of the mold.

6. After the investment is set, a separator is applied and the upper half of the flask is poured in stone. The stone will give a sharper impression of the labial surface of the pattern than will plaster.

7. The wax is eliminated with boiling water and a separator is applied to the mold and allowed to stand for a few minutes until there is a good film throughout the entire mold.

8. Packing of the case is done either by the dry-pack method or the dough-mix method. If the latter is used, double flasking of the upper half of the flask is necessary in order to obtain the proper blend of the body and incisal shades.

9. Processing should be carried out according to the directions given by the manufacturer for the type of methyl methacrylate used.

10. Finishing is done with stones and disks, preferably in the mouth so that harmony of contour, exactness of anatomy, and the creation of symmetry can be attained. Pumice for polishing should not be used, since the labial irregularities, so necessary for the reproduction of a natural tooth, will be removed. The high gloss can be produced by using a wax polish on a rag wheel.



FIGURE 3. Completed acrylic dowel crown cemented in place, left maxillary cuspid.

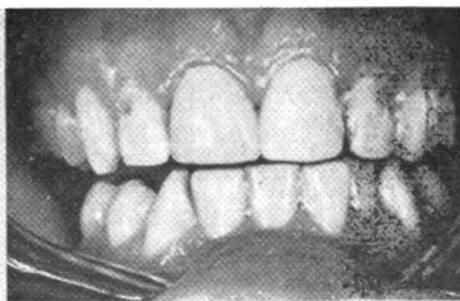


FIGURE 4. Completed acrylic dowel crown cemented in place, right central incisor.

11. Cementation of the completed acrylic dowel crown (figures 3 and 4). A translucent posterior cement, such as Petralit or Oxilit, used in a fairly thick, stringy consistency, has proved most satisfactory. After the crown is brought to place by finger pressure, it is then given a sharp blow with a mallet and an orangewood stick to ensure complete seating of the crown. The excess cement is left in the form of a roll around the crown margin until the cement is completely set. This will protect the actual cement margin and keep moisture from it until the cement is set.

The anterior acrylic dowel crown has proved to be most useful because of the accuracy of fit and because of the simplicity of its construction. This type of crown lends itself very well as an abutment for a fixed bridge.

Spontaneous Pneumothorax in Soldiers

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The relatively high incidence of spontaneous pneumothorax among otherwise normal, young soldiers has stimulated a study of such cases admitted during the last twelve months to the Station Hospital at Seymour Johnson Field. Thorough investigation of relatively minor complaints has revealed an incidence of spontaneous pneumothorax heretofore unrecognized. This has been emphasized in our cases, which have been diagnosed as myalgia, pleurisy, and angina pectoris in civilian life, for complaints similar to those which were found due to small areas of pneumothorax when more thoroughly studied. Because of the recurrent nature of the disease, the possibility of serious disability, and the necessity for proper disposition, an early, correct diagnosis should be made.

Seven cases of spontaneous pneumothorax have been studied during the last twelve months. Case No. 1 was a representative case. Between the ages of 12 and 15 years, he had six attacks similar to the present one. One month previously he had been hospitalized on this field for a severe attack of chest pain, requiring a hypodermic of morphine, which at first was diagnosed coronary disease, but subsequently was considered to be bronchitis. The present attack occurred twelve hours before entry into the hospital, while playing basketball. The onset was sudden with severe pain in the left chest and marked shortness of breath. He retired for the night with a moderate amount of chest pain remaining and some dyspnea on slight exertion. At the hospital the following morning, he was moderately dyspneic and showed slight limitation of motion of the left chest with diminution of

TABLE I

Case No.	Age	Number of previous attacks	Personal history	Complaint on entry
1	21	7	Not significant.	Sudden onset left chest pain and dyspnea during exertion.
2	21	None.	Not significant.	Gradual onset left chest pain, while at rest.
3	19	5	Pertussis in childhood.	Sudden onset right chest pain with dyspnea and right pleuritic pain. Concurrent nasopharyngitis.
4	22	5	Exposure to tuberculosis.	Gradual onset left chest pain during exertion.
5	23	0	Not significant.	Sudden onset right chest pain with dyspnea, awakening him from sleep.
6	23	1	Not significant.	Sudden onset left chest pain during exertion.
7	23	2	Exposure to tuberculosis.	Sudden onset left chest pain, radiating to left shoulder with dyspnea, while at rest.

breath sounds. The left apical region was hyperresonant to percussion. A roentgenogram revealed a collapse of about 25 percent of the left lung. The treatment was symptomatic, and uneventful recovery occurred. The left lung had completely re-expanded sixteen days after admission. This case demonstrates most of the significant features of the mild type of pneumothorax with which we are concerned—the frequent, preceding undiagnosed attacks, the pain, and the dyspnea. One feature, the fine crackling rales, is not present.

Tuberculosis was not a significant etiologic factor in this series of cases. Questionable tuberculosis contact occurred in 2 cases; however, in no instance was clinical or laboratory evidence found to suggest the presence of tuberculosis. Respiratory disease was not a precipitating factor with the possible exception of one case.

Among the 7 cases, 5 had suffered from 1 to 7 attacks of chest pain similar to the present attack. Data regarding the previous attacks were incomplete, but they undoubtedly represented episodes of pneumothorax. In this series, pneumothorax occurred five times on the left side and twice on the right. The age of the patients ranged from 19 to 23 years. The present episode was associated with exercise in 3 cases and not associated with undue exertion in 4 cases; the onset of the attack occurred during sleep in one instance. The outstanding complaint was the sudden or gradual onset of chest pain on the involved side. The pain was constant, sometimes pleuritic in type, or was both constant and aggravated by deep breathing. Dyspnea was proportional to the extent of pneumothorax. Pain, although also proportional to the extent of collapse, was present in all patients. In one patient, entry into the hospital was delayed for six days after the onset of symptoms. In another patient, the pain was precordial, referred to the left shoulder, and simulated pain of cardiac origin.

Physical findings depended on the amount of lung tissue collapsed. The classical symptoms of pneumothorax—hyperresonance, absent breath sounds, mediastinal shift—were found when more than 50 percent collapse occurred. In minor degrees of collapse, the physical findings were atypical, sometimes consisting of only fine moist rales over the involved area.

Uneventful recovery occurred after the acute symptoms subsided in most cases. In one instance, withdrawal of air was

TABLE II

Case No.	Physical findings in chest	Diagnosis on duty	Hospital course	X-ray examination	Days required for re-expansion
1	Limited expansion, hyperresonance, and decreased breath sounds, left, with shift of cardiac dullness to right.	Pneumothorax, spontaneous, left.	Uneventful. No chest pain, dyspnea, or fever.	Pneumothorax left; 25% collapse, small amount fluid left costophrenic angle.	16
2	Moist rales, left lower lung field.	Bronchopneumonia.	Uneventful. No chest pain, dyspnea, or fever.	Pneumothorax left; 10% collapse.	12
3	Fine, scattered rales, right base.	Atypical pneumonia, pleurisy, right.	Febrile period 6-9th hospital day, associated with right chest pain.	Pneumothorax right; 15% collapse.	5
4	Injection nasopharynx. Limited expansion, hyperresonance, and decreased breath sounds left.	Nasopharyngitis.	Uneventful. No chest pain, dyspnea, or fever.	Pneumothorax left; 10% collapse.	10
5	Hyperresonance, decreased tactile fremitus and breath sounds right.	Pneumothorax, spontaneous, right.	Dyspnea sufficient to require removal of air from right chest. Subsequent course uneventful.	Pneumothorax right; 90% collapse, with mediastinal shift to left.	37
6	Limited expansion, hyperresonance, absent tactile fremitus and breath sounds upper left lung field.	Pneumothorax, spontaneous, left.	Uneventful.	Pneumothorax left; 50% collapse. Small amount fluid left costophrenic angle.	24
7	Hyperresonance decreased tactile fremitus and breath sounds. Left fine rales, apex and base, "knocking" precordial sound. Found 24 hr. after admission on re-examination.	Pneumothorax, spontaneous, left.	Uneventful.	Pneumothorax left; 15% collapse. Air in mediastinum. Small amount fluid left costophrenic angle.	12

necessary to relieve pain and dyspnea. In another, an elevation of temperature with recurrence of mild chest pain was experienced. The time required for re-expansion of the lung ranged from three to thirty-seven days, with an average of sixteen days. Delay in re-expansion occurred in cases which sustained greater collapse. X-ray examination confirmed or established the diagnosis and was helpful in following the course of re-expansion of the lung. A small amount of fluid in the costophrenic angle on the involved side was a frequent finding. Likewise, a slight thickening of the apical pleura on the involved side was noted in several cases after re-expansion of the involved lung had occurred. Both of these manifestations were considered due to a mild inflammatory reaction incident to the introduction of air into the pleural cavity.

COMMENT

The underlying cause of spontaneous pneumothorax was formerly considered to be tuberculosis. Recent studies^{1 2} as well as our series of cases, reveal no significant association of tuberculosis with the incidence of spontaneous pneumothorax. Ornstein and Lercher, who reviewed 58 cases of spontaneous pneumothorax, concluded, on the basis of histologic and roentgenologic studies, that spontaneous pneumothorax occurred frequently in otherwise normal lungs and was dependent on the rupture of subpleural, emphysematous blebs into the pleural cavity. Such blebs were formed by the weakening and rupture of alveolar elastic fibers and occurred especially in young subjects under the influence of exertion and increased intrathoracic pressure with a closed glottis and fixed diaphragm. The apices of the lung were involved more frequently because of the less rigid nature of that area of the chest wall. Some emphysematous bullae possessed a ball-valve opening which induced progressive enlargement of the bleb, even with the patient at rest. Scar formation and the associated weakness of pulmonary structures were also cited as a cause of pneumothorax. Agreement with this theory is suggested in our series of cases by the history of repeated attacks in otherwise normal, young subjects, the rapid closure of the pulmonary defect with re-expansion of the lung, and the benign clinical course. The cases of spontaneous pneu-

1. Ornstein, G. G., and Lercher, L.: Spontaneous Pneumothorax in Apparently Healthy Individuals; Clinical Study of 58 Cases with a Discussion of the Pathogenesis, *Q. Bull. Sea View Hosp., N. Y.*, 7:149-187, April 1942.

2. Hamman, L.: Note on Mechanism of Spontaneous Pneumothorax, *Ann. Int. M.*, 13:923-926, December 1939.

mothorax reviewed by Stein, McConkie, and Kuehn³ are of patients who sustained a massive collapse of lung tissue and present the usual symptoms of pneumothorax.

That pneumothorax may be frequently overlooked in civilian practice is suggested by the frequency of erroneous diagnosis which occurred in our patients who exhibited minimal physical findings and whose recovery was rapid and uneventful.

This study impressed us with certain features which seem to be of diagnostic aid in recognizing these cases. Recurrent bouts of chest pain, in otherwise normal, young individuals, unaccompanied by friction rub or fever, but often associated with fine crepitant rales in the area of pain, suggest spontaneous pneumothorax and warrants x-ray study.

SUMMARY

This study calls attention to the relatively frequent incidence of spontaneous pneumothorax and the clinical features of cases with minimal amounts of lung collapse.

Lumbar Puncture Headaches

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The recent order permitting induction into the armed forces of men with syphilis, provided they do not have neurologic or visceral involvement, has given rise in the induction centers to a large number of diagnostic spinal punctures. These taps have been made mostly in places where the hospital facilities are sufficient to permit keeping the men overnight or sometimes for three days. Accordingly, they were handled conservatively and given twelve hours of complete bed rest and twenty-four hours of partial bed rest. Our series of 2,237 punctures was performed in a sixty-bed hospital which is always filled nearly to capacity. We had, therefore, no choice but to resort to the ambulatory technique. All of these patients had a history of positive blood serology or of antiluetic therapy, and yet there were only 15 cases of mild or moderate postspinal headache of more than twenty-four hours' duration. Of the 2,237 taps, only 20 were unsuccessful

3. Stein, G. H., McConkie, E. B., and Kuehn, A. J.: Spontaneous Pneumothorax, *War Medicine*, 4:324-330, September 1943.

on the first attempt and had to be repeated. Of a total of 2,217 patients, 15 had moderate reactions. Various authorities give the incidence of postspinal headaches as from 15 to 35 percent of their patients. In our large series, the incidence was less than 1 percent. The Journal of the American Medical Association¹ recently stated editorially that further studies will be required to elucidate the mechanism of postpuncture headache and its successful prevention. Torbert,² who in 1934 found that lumbar puncture could be performed on ambulatory patients, kept them lying down in the hospital for two hours postpuncture and advised them to retire on reaching home. In Davenport's³ series of 681 punctures, the patients were advised to rest on returning home. He records 223 headaches of an average duration of 4.32 days. Adler⁴ in a group of 108 cases remarks, "The sooner a patient goes to bed after a diagnostic spinal tap, the more apt he is to have a headache and the more likely it is to be a severe headache." Our experience has borne out his observation.

METHOD OF PROCEDURE

Our observations on a large group of men were made under nearly constant conditions. They were draftees for the armed forces between 18 and 38 years of age, all in acceptable physical condition but for the history of syphilis or of repeatedly positive blood serology. All punctures were performed by three operators, the author alone doing more than 1,500. We agree with Kulchar and King,⁵ who said that difficulty in entering the canal, the number of dural wounds, and the amount of fluid withdrawn are not causal factors in producing headaches. In our 15 cases which had headaches, there was no particular difficulty in performing the punctures.

Because of the large number examined and the limited bed capacity of the hospital, changes in the previously accepted postoperative procedure were necessary. The technique of the operation was simplified permitting, toward the latter part of the series, lumbar punctures on an average of

1. Reactions Following Spinal Puncture (Editorial), J. A. M. A., 123:355, 9 Oct. 1943.

2. Torbert, H. C.: The Safety of Lumbar Puncture for Ambulatory Patients, Arch. Derm. Syph., Chic., 30:692, Nov. 1934.

3. Davenport, K. M.: Postpuncture Reactions, N. York State J. M., 39:1185, 15 June 1939.

4. Adler, H.: A Study of the Headaches Following Diagnostic Spinal Taps, N. York State J. M., 43:1328, 15 July 1943.

5. Kulchar, G. V., and King, A. D.: The Use of Sodium Amytal in the Prevention of Reactions Associated with Lumbar Puncture, Arch. Neur. Psychiat., Chic., 30:170, July 1933.

fifteen patients per hour. No pre- or postoperative medication was employed. The use of novocain locally was abandoned after the early part of the series as a No. 20 spinal needle caused very little more discomfort to the patient than a 24-gage hypodermic needle.

The patients were placed on the operating table, recumbent on the left side with the back arched toward the operator. The skin was prepared with iodine and alcohol and the needle inserted between the second and third or third and fourth lumbar vertebrae. In most cases this was accomplished without touching the patient's skin with the gloved hand. The location of the skin dimple over the interspace was noted and the needle was inserted slightly to the patient's right of the mid-line of the back. Occasionally the fluid contained some blood but it usually cleared up on withdrawing the needle 0.5 cm. In the cases which did not clear, a second tap one interspace higher was frequently clear. Seven cases required a second attempt at a one-week interval.

Contrary to Ives,⁶ Jones,⁷ and others, we feel that the more quickly the tap can be performed, the less likelihood there is of reaction. This bears out Adler's ideas of the psychogenic influence on headaches following lumbar puncture. Although taps can be done more quickly with the patient sitting up, we used the recumbent position because of the physical setup of our room and because it affords the patient greater comfort. An average of 10 cc. was taken from each patient, in two tubes, from 1 to 2 cc. in the first tube and the remainder in the second.

Immediately after withdrawing the needle, the patients were instructed to dress and proceed with the day's activities as though nothing had happened. They were specifically instructed not to "take it easy" or lie down. It was necessary to hospitalize only ten patients because of postspinal headaches. Five others reported severe headaches but were not hospitalized. Those hospitalized were treated merely by bed rest and liquid diet. All responded favorably with a maximum of three days' hospitalization. A few other patients had mild postspinal headaches for twenty-four hours or less but the vast majority felt no untoward symptoms.

6. Ives, G.: Spinal Puncture and Spinal Fluid, J. Missouri M. Ass., 31:152, April 1934.

7. Jones, W. A.: Indications for Spinal Puncture, J. Arkansas M. Soc., 33:181, May 1936.

MacRobert⁸ represents the cause of reactions following spinal puncture as the loss of cushion for the brain due to loss of fluid. He says there is congestion due to pressure on the basilar vein which occurs only when the arachnoid is pulled through the hole in the dura. Schube and LeDrew⁹ recommend the use of sodium amytal as a preventive and review the literature. Our findings indicate that a likely etiologic theory is that of intracranial hypotension and lowered spinal pressure. Moderate exercise and maintenance of the erect position following puncture tend to increase the tension, thus preventing a compensatory oversecretion of fluid accompanied by hypertension and headache.

SUMMARY

Lumbar spinal punctures were performed during a five and one-half month period on 2,217 luetic candidates for induction into the armed forces. The fluids were collected rapidly; the patients got on their feet immediately and were instructed to keep active and not lie down. Only 15 cases of postpuncture headache severe enough to require bed rest were reported. These responded to from one to three days of bed rest and liquid diet.

Rapid collection of spinal fluid and maintenance of the erect position postpuncture apparently decreased the number of postspinal headaches in this series to less than 1 percent. This is believed to be due to the more nearly normal intracranial pressure maintained by the erect position, thus preventing oversecretion and compensatory hypertension with resultant headache.

8. MacRobert, R. G.: The Cause of Lumbar Puncture Headache. J. A. M. A. 70:1350, 11 May 1918.

9. Schube, P. G., and LeDrew, F.: Prevention of Reactions Due to Lumbar Puncture. N. England J. M., 211:537, 20 Sept. 1934.

Horse Leech Infestation.—The true horse leech (*Limnatis nilotica*) is frequently found in Anatolia as a foreign body in the upper respiratory and food passages. The upper respiratory or pharyngeal tract may be invaded by one or more leeches. Infestation with this parasite occurs from drinking unboiled water. As blood leeches swim about freely in water during the hot season, all cases of this type were observed between the months of June and October. It is usually recommended that the leech be removed from the larynx without anesthesia by means of forceps, gripping the leech in its entire length. In this way is avoided the danger of the animal's loosening itself as a result of cocainization and falling deeper into the windpipe.

Bacteriologic Study of Mess Equipment

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Improperly washed eating and cooking utensils have long been considered as potential agents of transmission of certain communicable diseases. Most of the studies dealing with this phase of sanitation have been of civilian eating and drinking establishments.^{1 to 7} With the advent of the present war the problem arose of maintaining proper sanitation of mess equipment among the armed forces under conditions different from those in civilian life. The purpose of our investigation was to evaluate the effectiveness of existing practices in the Army under field conditions. In our studies an attempt was made to apply accepted civilian practices as far as seemed reasonable, modifying them as deemed necessary to fit existing conditions. On the basis of our findings, certain changes in procedure are suggested, and also recommended methods are outlined for future surveys such as ours. The data to follow were obtained during the Louisiana maneuvers of 1942.

PROCEDURES

The method employed for swabbing and culturing was a modification of that recommended by Fellers, Levine, and Harvey.⁶ Sterile cotton swabs in three cubic centimeters of

Accepted for publication, 1 October 1943.

This paper has been abbreviated by the omission of several tables showing the details of the bacteriologic studies in various organizations. A summary of these details appears in table I.

1. Calver, H. N.: A Neglected Opportunity for the Control of Respiratory Disease, *Am. J. Pub. Health*, 25:953, 1935.

2. Krog, A. J., and Dougherty, D. S.: Effectiveness of the Methods of Dish and Utensil Washing in Public Eating and Drinking Establishments, *Am. J. Pub. Health*, 26:897, 1936.

3. Hitchens, A. Parker, Chairman, Subcommittee on Standard Methods for the Examination of Dish-Washing Devices, *American Public Health Association Yearbook*, 1936-1937, pp. 47-48, Supplement to Vol. 27, No. 3, March 1937, *Am. J. Pub. Health*.

4. Baker, J. G., and Stone, R. V.: Sanitization of the Drinking Glass, *National Association of Sanitation, Inc.*, 1938.

5. Devereux, E. D., and Mallmann, W. L.: Efficiency of Methods and Products for Sterilization of Beverage Glasses, *Am. J. Pub. Health*, 26:165, 1936.

6. Fellers, C. R., Levine, A. S., and Harvey, E. W.: Bacteriological Examination of Glassware or China for Sanitary Quality, *Am. J. Pub. Health*, 26:1211, 1936.

7. Walter, W. G., and Hucker, G. J.: Proposed Method for the Bacteriological Examination of Flat Surfaces, *Am. J. Pub. Health*, 31:487, 1941.

sterile physiologic saline were used. After squeezing out the excess liquid, the swabs were passed, in the case of mess kits, over the inner and outer rim which the hand had not touched, once around the inner side of the wall, and thoroughly over the bottom. A similar method was used on kitchen and officers' mess utensils. After obtaining the sample each swab was immersed with agitation in the sterile saline in the original tube, was squeezed against the side of the tube to remove excess liquid, and was then placed into a fermentation tube containing ten cubic centimeters of sterile lactose broth. The three cubic centimeters of saline in the original tube were then used for pour plates employing seven cubic centimeters of nutrient agar. A colony count was done after forty-eight hours' incubation at 37° C. Any lactose broth tubes showing gas formation within forty-eight hours' incubation at 37° C. were subjected to the "completed test" for the demonstration of organisms of the coli-aerogenes group.⁸

TABLE I
Summary of results

Type of surveys	Number of surveys	Number of organizations	Number of utensils examined	Mean colony counts and percent of total samples positive for coli-aerogenes organisms over three temperature ranges*					
				41°C. — 60°C. Col.ct. %C—A		61°C. — 80°C. Col.ct. %C—A		91°C. — 100°C. Col.ct. %C—A	
Meat cans	11	9	131	41	18.4	19	13.0	53	0.0
Kitchen utensils	5	5	34	385	53.8	—	—	181	0.0
Officers' utensils	2	2	14	—	—	226	40.0	29	0.0

*Temperature ranges represent the highest average temperature to which the utensils were exposed in each case.

Samples of the wash and rinse waters were also collected and their temperatures recorded. These samples were subjected to the standard method for the bacteriologic examination of water using the "completed test" for demonstration of the presence of members of the coli-aerogenes group of organisms. Miscellaneous samples other than those mentioned above were taken as the occasion seemed to dictate and were similarly treated.

For the purposes of comparison, it seemed desirable to establish a system considered ideal from the standpoint of

8. Standard Methods for the Examination of Water and Sewage, American Public Health Association, 8th Ed., p. 210, 1936.

simplicity and of bacteriologic and gross cleanliness of mess equipment. This was set up in our own unit (Organization 10). For washing mess kits this consisted of three 33-gallon galvanized cans over a fire trench. The first can contained one-fourth bar of G.I. soap dissolved in about 22 gallons of water, resulting in a phenolphthalein alkalinity of about ninety parts per million, calcium carbonate, and a methyl orange alkalinity of about two hundred fifty parts per million, calcium carbonate at 75° to 85° C. The other two cans were two-thirds full of plain water maintained at a temperature of from 90° to 98° C. until all mess kits were washed. Half of a G.I. scrub brush, to which a long wooden handle was attached, was used to wash the kits. Dipping in the first rinse was followed by immersion in the second rinse until the man next in line had washed his mess kit and rinsed it once. Immersion for a period of forty-five to ninety seconds was obtained without holding up the wash line. The immersion time was found to play an important part in reducing the bacterial plate count, on the basis of the results of culture of 26 October 1942, Organization 10, when the kits were dipped momentarily and removed, in comparison with those of the same organization 24 and 28 October 1942 when held immersed. Rapidly boiling water makes immersion and holding difficult and defeats the purpose of the boiling temperature. For washing kitchen utensils two 33-gallon galvanized cans approximately two-thirds full of plain water were heated separately over a fire trench to from 90° to 98° C. Some of this water was transferred to a smaller tub, and soap was added in approximately the same proportion as mentioned in connection with mess kit washing. The balance of the water was used for rinsing in a fashion similar to that used for mess kits.

The findings are summarized in table I. The difficulties of attempting to summarize this type of data are appreciated. It was felt, however, that if the highest average temperature to which the utensils were exposed were used as a grouping criterion, a partial summary could be made.

· PROPOSED PROCEDURES FOR FIELD SURVEYS

In view of the fact that no practicable method is known to the authors for the bacteriologic evaluation of the sanitary quality of a given system of mess gear washing in the field, despite the great variety of methods used in civil establishments, the following is submitted as a proposed procedure:

I. Pertinent data to be recorded:

Date, time of mess.

Weather conditions encountered.

Number of men fed.

System of mess gear washing used.

Method of heating water.

Time (average) spent in the washing process by each man

II. General technique.**A. Time of sampling.****1. Mess kits:**

a. Before eating.

b. In those instances where a preliminary clear rinse is used, mess kits should be sampled before and after this rinse.

c. After eating, immediately after completion of the washing process.

2. Kitchen utensils:

a. Immediately after completion of the washing process.

3. Officers' mess utensils:

a. Before eating.

b. After eating, immediately after completion of the washing process.

B. Utensils selected as bases for comparison.**1. Mess kits:**

a. Meat can.

b. Canteen cup.

c. Fork.

2. Kitchen utensils:

a. Those having flat surfaces at least 4 inches square.

3. Officers' mess utensils:

a. Those having flat surfaces at least 4 inches square.

C. Number of utensils sampled.**1. Mess kits:**

a. Before eating: a number equal to 10 percent of the strength of the command.

b. Before eating, where a preliminary rinse is employed: a number equal to 10 percent of the strength of the command.

c. After eating, immediately after completion of the washing process: first man and every tenth man thereafter.

2. Kitchen utensils: ten.**3. Officers' mess utensils: ten.****D. Method of sampling.**

1. General. Use cotton swabs on wooden applicator sticks (two) of stiff wire if available, sterilized in ordinary culture tubes with three ml. of physiologic saline solution. Excess fluid is pressed out of swab by pressing against side of tube, the lip of the tube flamed, the utensil swabbed firmly, the lip of the tube flamed, and the swab replaced so as to be immersed in the saline solution. The samples are returned

immediately to the laboratory, agitated by holding firmly in the hand and striking 25 times, the excess fluid squeezed out of the swab, the swab transferred to a tube containing 10 ml. of plain lactose broth as used in bacteriologic water analysis, and the fluid remaining in the tube introduced into sterile Petri dishes, using aseptic precautions. Approximately 10 ml. of the standard agar used in bacteriological water analysis is melted, cooled to 40°-44° C., and mixed with the fluid in the Petri dishes; these plates are allowed to harden, are inverted, and incubated at 37° C. for forty-eight hours. The colonies are then counted and recorded.

Any lactose tubes showing fermentation within forty-eight hours' incubation at 37° C. are subjected to the completed test for the demonstration of the presence of the coli-aerogenes group of organisms, as outlined in *Standard Methods for the Examination of Water and Sewage*.⁸

2. Surface swabbed.

a. Mess kits.

- (1) Meat can: three times around inner rim, once around inner wall, and thoroughly over the bottom.
- (2) Canteen cup: once around outer and inner rim, in a spiral fashion down the inner wall so as to thoroughly cover its area, and thoroughly over the bottom.
- (3) Fork: once over front, once over back, then once between each pair of tines.

b. Kitchen utensils: a flamed sheet metal frame with a four square inch opening is held against the inner flat surface of the utensil selected, and the swab rubbed slowly and thoroughly three times over the surface delineated by the frame.

c. Officers' mess utensils: as for kitchen utensils.

3. Standard used: Standards for field conditions for the method and utensils outlined remain to be established.

E. Soapy and rinse waters.

1. Temperatures (C.) of soapy and rinse waters should be taken and recorded:

- a. Just before use.
- b. After 20 men have washed their mess gear.
- c. Just after the last man has washed his mess gear.
- d. Just before, during, and just after the washing of kitchen and officers' mess utensils.

2. Samples (120 ml.) of both rinse waters to be taken in sterile sample bottles at the times specified for the taking of temperatures, just before taking the temperature.

a. These samples to be returned immediately to the laboratory and subjected to the standard agar plate count method and the completed test for the presence of coli-aerogenes group of organisms, as outlined in *Standard Methods for the Examination of Water and Sewage*.⁸

SUMMARY

These observations seem to indicate that:

1. The method used for determination of the approximate bacterial population of the utensils gave results which corre-

lated well with observed practices and conditions in the messes examined. When adequate precautions were taken to insure proper cleansing of mess gear and maintenance of proper temperature in the wash and rinse water, the bacterial plate counts were satisfactory.

2. The presence of coli-aerogenes group organisms was also well correlated, in general, with observed practices and conditions in the messes examined. The presence of these organisms seems traceable in many instances, to hand-contamination of the wash and rinse waters, either directly, or indirectly via the utensils handled. It might be said as a matter of interest that the colonies on eosin methylene blue agar plates in many cases had the appearance described as typical for colonies of *Escherichia coli*. Species determination was not done routinely, however, being considered unnecessary for this type of examination.

3. Differences in mean colony counts of meat cans in the three temperature ranges observed, were not appreciable.

4. The temperature range 41°-80° C., as employed under the conditions noted, was not effective in destroying coli-aerogenes group organisms, whereas the temperature range 91°-100° C. was effective.

5. Judging from comparative mean colony counts and percent of total samples positive for aerogenes organisms in the utensils examined, sanitary precautions during the washing of officers' mess utensils and kitchen utensils tend to be relaxed.

6. Adequate soap content and temperature of the soapy water, an efficient brush, adequate temperature of the two rinse waters, and adequate holding time are essential for efficient mess gear sanitation. Adequate holding time may be achieved in the case of mess kits, if each man, after scrubbing and one rinsing, will hold his kit in the second rinse until the man next in line has finished the first rinsing.

7. Wash water too hot to be tolerated by the hands, and a long-handled scrub brush would also seem desirable from the standpoint of elimination of the factor of hand-contamination of the wash and rinse waters.

8. A procedure for bacteriologic surveys of mess gear sanitation similar to that proposed would seem more applicable to field conditions than the methods in current civil use.

Apparatus and Clinical Notes

ROENTGEN STEREOSCOPY

A Method for Increasing Stereoscopic Effect

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Klein et al.¹ have recently pointed out long-standing errors in roentgen stereoscopy. These authors have shown that the old principle of shifting the x-ray tube the interpupillary distance for roentgen stereograms has no sound basis on fact. They found that, if the shift of the shadow of any object in two stereoscopic roentgenograms was more than three-eighths of an inch (0.95 cm.), the images could not be fused satisfactorily by persons of average stereoscopic vision. The authors proposed a formula for calculating the tube shift for each thickness of the part so that the farthest object shadow shift would not be more than three-eighths of an inch.

This formula has been tried and has been found to improve greatly the quality of stereoscopic roentgenograms. In some cases the improvement is amazing, particularly in stereoscopic chest films. On the machine used, the former stereoscopic shift for a 6-foot chest plate was 6.5 in. By applying the formula of Klein et al., it was reduced to 2.4 in. The stereoscopic image in the films made with this short shift has much more depth than in those films made with the long shift. Application of this formula is equally effective when used on other parts of the body, since almost invariably the usual stereoscopic shifts now used are greater than would give the proper object image shift.

The following simplified formula has been evolved for use by Army x-ray technicians:

$$\frac{\text{Anode film distance} - \text{Thickness of part (in cm. or in.)}}{\text{Thickness of part (in cm. or in.)}} = \text{Tube shift in centimeters}$$

This formula was evolved by assuming that the error introduced in changing the factor of 0.95 cm. (three-eighths of an inch) to 1 cm. would be insignificant and the introduction of the factor of 1 in the equation greatly simplifies it. Because this formula is empirical, it must be noted that, regardless of whether centimeters or inches are used in the numerator and denominator, the result is always expressed in centimeters. For example, if stereoscopic films are to be made with a 72-in. anode film distance on a chest measuring 10 in. in thickness, the ratio is as follows:

$$\frac{72-10}{10} = 6.2 \text{ cm. (2.4 in.) tube shift}$$

This simple formula can be applied for stereoscopic films of any part of the body. It has been found that technicians can learn to use it in one very short lesson, and the resulting improvement in stereoscopic films is well worth the time involved.

Average shifts for 30-in. anode film distance have been calculated for various parts of the body as follows:

P. A. skull.....	2.8 cm. (1.1 in.)
Lateral skull.....	3.7 cm. (1.45 in.)
Pelvis	1.9 cm. (.75 in.)
Knee	5.3 cm. (2.1 in.)

Because of the very short shifts used in this stereoscopic technique, the first exposure is made with the central ray centered exactly as though a single film were being made, and the second exposure is made by shifting the tube in either direction the amount called for by the formula.

1. Klein, E., Klein, M., Klein, H., and Newman, A. T.: Investigation into Some Practical Aspects of Roentgen Ray Stereoptics, Am. J. Roentgenol., 49:682-690, May 1943.

APPARATUS FOR INTRAVENOUS ANESTHESIA

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Most apparatus on the market for the administration of intravenous anesthesia is expensive. The apparatus described here includes an arm board with the intravenous setup and costs, excluding the syringe, about one dollar seventy-five cents for the valve and tubing. In addition, some lumber and one hour of a carpenter's time are needed.

An intravenous setup must overcome the two main difficulties: (1) blood coming back into the needle and clotting; (2) a syringe so far from the anesthetist that he is unable to watch the patient's airway and to administer oxygen or nitrous oxide and oxygen. This apparatus overcomes

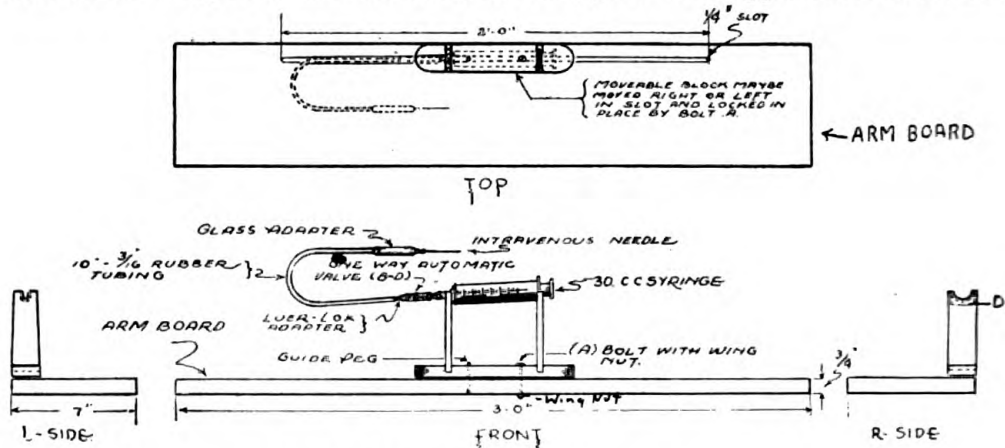


FIGURE 1. Diagram of apparatus.

these difficulties. The one-way automatic valve does not permit a backflow of blood from the vein to enter the apparatus and to clot. Occasionally after autoclaving, the rubber valve may stick, but it may be freed with a sterile needle. The stand holds the syringe securely so that one need only reach over from time to time to administer the anesthesia. Both hands are free to administer oxygen or oxygen and nitrous oxide.

The apparatus consists of an arm board with a movable syringe holder. The hub of the syringe fits halfway down in a groove (D). The syringe holder slides along the arm board by means of a bolt (A) fitting into a 1/4-inch slot in the arm board and held in position by a wing nut. To use opposite arm, the wing nut is loosened and the holder is swung through

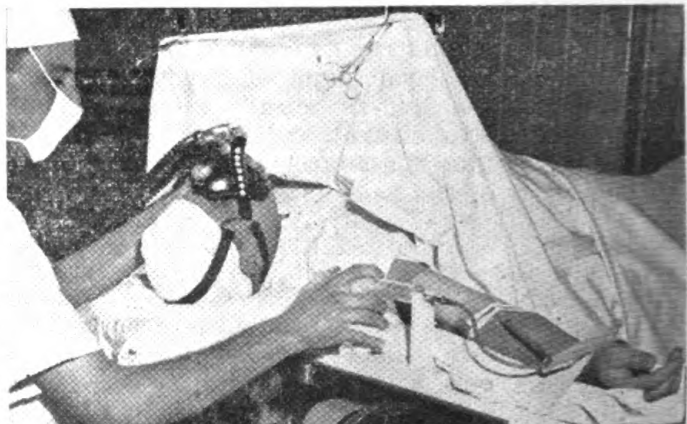


FIGURE 2. Anesthetist administering intravenous and supplementary anesthesia.

an arc of 180°. A strap has been added to the arm board to steady the patient's arm. The strap slides along a bar on both sides of the arm board.

BACTERIOLOGIC MEDIA FOR SHIPS' HOSPITALS

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Media for bacteriologic work may be prepared in the port of embarkation and, when properly packed and stored, it will keep satisfactorily on board ship for five months in tropical waters. Large-scale preparation of media for ships' hospitals has been undertaken.

The media supplied were Loeffler's blood serum slants, blood agar plates, brain heart infusion broth tubes, nutrient agar slants, lactose broth fermentation tubes (for water), brain heart infusion broth flasks for blood and spinal fluid, all of which were made from standard items in the Medical Supply Catalog. The packages and containers used were standard glass tubes, vials, and flasks available through the medical supply office. The directions for the preparation of each medium were carefully followed and sterility controls were repeatedly made.

Loeffler's blood serum slants were supplied to the ship's hospital in screw-topped test tubes (Med. Dept. Item No. 4438500) containing 8 cc. of Loeffler's blood serum medium (Med. Dept. Item No. 1106600) and prepared according to the directions supplied with the dehydrated medium. The medium was extremely well preserved even after six months in the ship's refrigerator and supported excellent growth of *Corynebacterium diphtheriae* and other organisms after this time (figure 1). Considerable liquid serum was left in the tubes during preparation. The medium was warmed to room temperature before inoculation and incubated with the screw-top caps off.

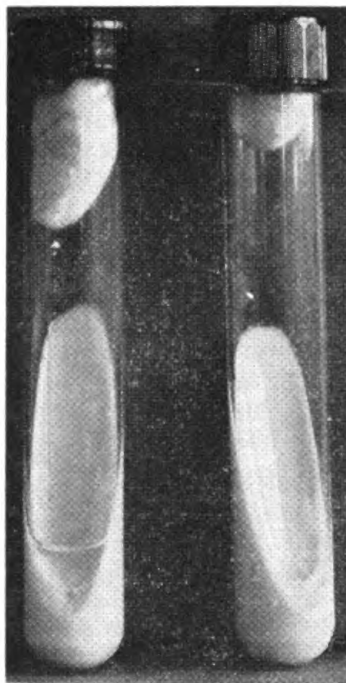


FIGURE 1. Loeffler's medium in screw-top test tubes before and after five months' storage. Signal Corps photographs.



FIGURE 2. Blood agar plates in screw-top, 2-ounce vials.

Blood agar plates were supplied in sturdy, 2-oz., screw-top vials (Med. Dept. Item No. 7947000) as 5 percent sterile horse blood in blood agar base (Med. Dept. Item No. 1106550) (figure 2). The bottles were plugged and sterilized; then 8 to 9 cc. of the melted-cooled medium were aseptically added and the vials laid on the flat side. When cooled, a medium surface about $1\frac{1}{2}$ by 3 inches was available for inoculation. The vials must be stored on their sides and care taken to prevent dislodgment of the medium. Excellent growth of streptococci, pneumococci, and other organisms was supported on this medium after five months of refrigerator storage. Inoculation was made by removing the screw top, then handling the vial like a test tube,

inoculating the medium with a swab or loop. Care must be taken to prevent too heavy inoculation. Incubation is carried out with the screw cap off and the medium vial on its side. Colonies can be picked and the type of growth viewed very readily through the sides of the glass container.

The rest of the media supplied—infusion broth, nutrient agar slants, and lactose broth—were dispensed in the screw-top test tubes described for Loeffler's medium. All of these media showed excellent state of hydration, sterility, and preservation. All media tested showed well-retained ability to maintain luxuriant growth of suitable organisms after six months of storage aboard ship.

Blood and spinal fluid culture flasks. Round, screw-capped bottles, 120-cc. (Med. Dept. Item No. 4056400), with vaccine-bottle caps of rubber (Med. Dept. Item No. 4088000) were filled with 60 cc. of brain heart infusion broth (with 0.1 percent agar and 0.2 mg. per 100 cc. para-aminobenzoic acid added) (figure 3). Blood or spinal fluid was drawn aseptically and transferred through the rubber vaccine-bottle cap into the medium with a syringe. No contaminations were reported and the medium supported excellent growth of meningococci, streptococci, and other fastidious organisms after five months' storage on board ship.

Discussion

Our experience indicates the possibility of preparing bacteriologic media in port for use in ships' hospitals during long voyages. Necessary to success are accurate and complete sterility controls on the prepared media and packaging the media in screw-top, sturdy, glass containers. This type of container will withstand storage aboard ship and prevent dehydration or contamination of the media. Long-term storage did not appear to destroy the nutrient properties of the media packaged as described.



FIGURE 3. Blood and spinal fluid culture flask.

ATABRINE PIGMENTATION OF THE SCLERA

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The majority of persons who regularly take 0.6 gm. or more of atabrine per week, in time, develop more or less pigmentation of the skin, because of the deposit of the drug which is a yellow dye. This is most noticeable around the mouth, in the hands and feet, and can be more readily seen when the skin is under tension. In about 50 percent of persons taking atabrine the pigmentation of the skin is more generalized and quite marked. This seems to occur particularly in those with dark skin and hair.

In spite of marked coloration of the skin, the sclera usually remains clear. This is commonly used as a differential point from jaundice. Occasionally however the sclera becomes slightly yellow in persons whose skin shows considerable atabrine pigmentation. In such cases the differential diagnosis from jaundice may be difficult.

In two such cases observed recently the icteric indices were well within the normal range on repeated estimations. Both patients had been transferred from other hospitals with the diagnosis of jaundice due to infectious hepatitis. Looking closely at the sclera of these patients, it was apparent that the coloration was most marked around the limbus, in the part of the sclera exposed in the palpebral fissure, and faded toward the

fornices. The fatty areolar tissue in the fornices appeared quite devoid of pigmentation. In jaundice of the sclera on the other hand, the pigmentation is most marked in the fornices, toward the equator of the globe, definitely fading toward the limbus. This observation may be of value in differentiating jaundice and atabrine pigmentation where laboratory facilities are not available.

SIMPLE TECHNIQUE FOR FOREIGN BODY LOCALIZATION

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Numerous methods of foreign body localization have been proposed. The purpose of this paper is to describe a simple accurate technique that will overcome certain disadvantages to some other methods. The necessary equipment consists of a standard fluoroscopic-radiographic unit plus an opaque-tipped rod and depth tables or curves. Routine radiographic studies are usually made to record the presence of a foreign body and to determine its approximate location. If the removal of the foreign body is considered advisable, it can be readily localized by the following technique.

The patient is comfortably and securely placed in a position suitable for surgical removal of the foreign body. Under fluoroscopic control, the position of the object is accurately located in a true vertical plane on the

skin by using a very small screen aperture and placing the opaque-tipped rod on the skin over the most accessible edge of the foreign body. The skin is then marked with any of the usual marking inks.

A small lead marker is placed at the edge of the skin mark and a double exposure film made as follows (figure 1): the cassette is placed so that the foreign body (E) will be over one end of the film; the table is placed in zero position and the central beam centered directly over the skin marker (D); the tube is placed at a 30-inch target-film distance and the first exposure made with the factors as described below; the tube stand is then shifted eight inches (AC) and the tube angled 15 degrees toward the foreign body and the second exposure made with the same technical factors; the film is developed

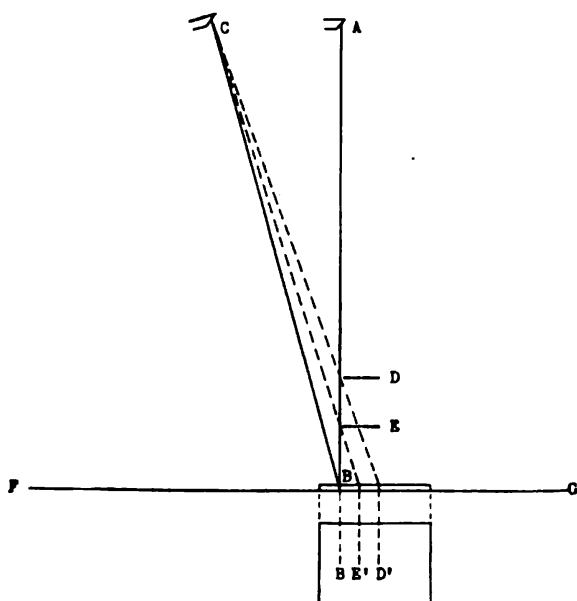


FIGURE 1. E, foreign body; D, superimposed skin marker; AB, first exposure, projects D and E at B on the film; CB, position of central beam on second exposure and forms a 15-degree angle with AB; E' and D', second-exposure projections of foreign body and skin marker on the film.

and the distance, in millimeters, between the same point on the two views of the foreign body (BE') is recorded; by comparing the latter measurement against the proper curve on the graph (figure 2), the distance of the foreign body from the cassette or table-top can be determined; the same procedure is carried out with

respect to the lead skin marker (BD'); the difference between the two measurements, obtained from the graph, will give the millimeter depth of the foreign body below the skin surface at the point indicated.

With Bucky technique, all but the necessary part of the film is protected with a strip of lead during each exposure. This will ensure good detail of both views of the foreign body and lead marker. With table-top technique, the ordinary factors for the part to be examined are used with the exception that the time is reduced one-half.

The skin is then permanently marked by making a small cut over the skin mark with a sharp scalpel. This will obviate the necessity of repeating the fluoroscopy should the ink be accidentally removed prior to surgical removal of the object and will also eliminate the unnecessary confusion that might be caused by disappearance of the ink mark following preoperative scrubbing of the skin and application of the various germicidal agents.

For surgical removal of the object it is absolutely essential that the patient be placed in the identical position that was used for radiographic localization. It is usually advisable for the radiologist to check the position of the patient on the operating table.

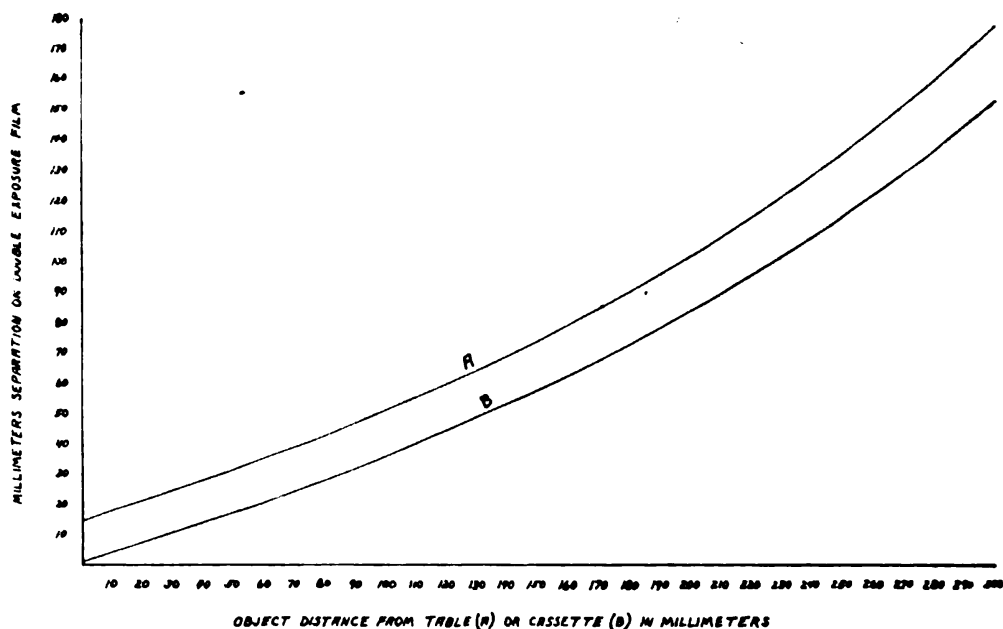


FIGURE 2. The vertical column is the measured distances of the foreign body (BE') and lead skin marker (BD') on the double-exposure film. Curve "A" is for Bucky technique and curve "B" is for table-top technique.

Conclusions

The success of a method for localization and removal of a foreign body is dependent on three factors: (1) localization in a true vertical plane; (2) accurate depth determinations; and (3) reduplication of the radiographic position at time of surgical removal.

The procedure presented requires no special equipment. This technique has been used in the removal of five foreign bodies with an average time of less than five minutes per case from the time that the incision was made.

A large series of unknowns were run in order to check the accuracy of the method and the results showed an average error of less than two millimeters.

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